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This Week

At Indianapolis there is about to be run the great annual classic. Out of this have emerged most of the refinements and improvements for automobiles. There is none better able to analyze the cars there this year than Chester S. Ricker. He has his ear to the ground and eye to the future and tells what it is all about from the technical development viewpoint on page 758.

The Summer Meeting of the S. A. E. is ready for the engineering minds of the industry to get together. Some of the papers to be presented there are digested beginning on page 768. More will appear in an early issue.

May Sales Near April's Peak

Less Than 10% Drop from Previous Month Expected; Only Moderate Decline in June

By Harold E. Gronseth

The advancing season has had only slight effect so far in stemming the tide of spring automobile sales, but irregularity is beginning to creep into delivery figures that are being reported from the field, suggesting that April doubtless will hold its traditional position as the peak month for sales. May, however, will be right on the heels of the best month of the year.

The trend is still upward for some manufacturers, their latest reporting period setting new high marks for the year. The industry as a whole is expected to finish the month just a shade under April's big retail volume, which totaled over 456,000 cars and trucks in the domestic market. Of this total, more than 391,000 were passenger cars and 65,000 were trucks—the latter a new high mark. This compared with 338,000 cars and 61,000 trucks in March and with 333,000 cars and 53,000 trucks in April, 1935.

No one expects the industry to go on indefinitely resisting the seasonal trend. Sales have held up surprisingly well so far, but some easing of the pace can be looked for from now on. Aggregate deliveries of eight leading companies up to May 20 were only 2000 cars under the April total for similar period, or less than 1 per cent. The final reporting period may widen the breach slightly, but final figures are expected to be only 5 to 10 per cent under the April volume.

(*Turn to page 754, please*)

More and Better Jobs

Can Be Had, Says Sloan, by Larger Provisions for Obsolescence

A solution for the unemployment problem in the form of promotion of obsolescence of the country's production facilities was offered by Alfred P. Sloan, Jr., president of General Motors, addressing the Bay area chambers of commerce in San Francisco early this week. Mr. Sloan said industry itself must further this program by making larger provisions for obsolescence, and that a sane tax basis, giving due credit for the replacement of outworn and outmoded facilities, is also necessary.

The result of such a program would be a more efficient and lower cost plant, with consequent gains in business. In the process of reconstruction, thousands of durable goods workers would be reemployed.

Two particular places where rebuilding would be advisable, said Mr. Sloan, are in the transportation field, where costs of service to industry are high, and in housing. Mr. Sloan said that the housing solution seems to be the mass production of finished components capable of being assembled on the job in minimum time and with common tools.

Alfred P. Sloan, Jr., president of General Motors, raised the flag at the dedication of the corporation's new Los Angeles plant May 23. R. H. Grant (left), vice-president of General Motors, W. S. Roberts, general manager of the Southern California division, and Marvine Scanlon assist at the ceremony.

Acme photo

Automobile Freight Rate Lowered

I.C.C. Permits Railroads to Reduce Carload Tariffs from Michigan Factories to Chicago

By L. W. Moffett

The Interstate Commerce Commission has granted railroads authority to maintain a rate of 50 cents per 100-lb. on passenger or freight automobiles and chassis, set-up, in carloads from Detroit, Lansing, Pontiac, and Flint, Mich., to Chicago without observing the long-and-short-haul provisions of the Interstate Commerce Act. This clause prohibits, in the absence of exemptions, the charging of a less rate for a long haul than for a short haul on the same line in the same direction.

The action of the commission makes permanent a rate which was reduced on April 15, 1935. Relief was asked by the railroads to enable them to meet motor truck competition from the points of origin to Chicago without reducing the present through rates from the same origins to destinations beyond Chicago.

The National Automobile Transporters Association and the Automobile Transporters Association of Michigan opposed the railroad application.

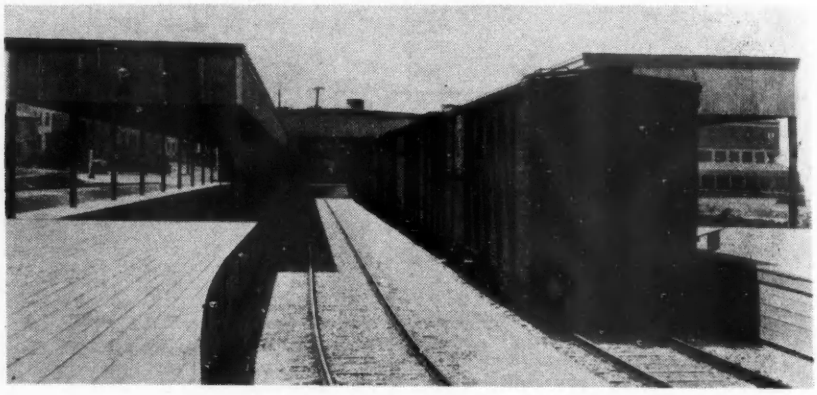
The reduced 50-cent rate applies from the automobile manufacturing points named to that part of Chicago known as Zone 1. To zones 2 and 3, charges of 80 cents and $2.40 per carload, respectively, are added to the basic 50-cent rate.

Zones 1 and 2 are separated by 79th St. and Zone 3 covers points in the South Chicago district.

Prior to the establishment of the reduced rate, the rates to Chicago were 60 cents from Detroit, Flint and Pontiac and 55 cents from Lansing, plus the authorized emergency charge of 2 cents per 100 lb. Approximately 5000 carloads of automobiles are transported from Michigan factories to Chicago each year. Prior to 1930, the I.C.C. report said, the rail lines transported practically all of this traffic, but subsequent to the spring of that year substantially all of the automobiles from Michigan manufacturing points to Chicago were conveyed by other methods of transportation.

The commission said that the diversion of this traffic and the resulting loss of revenue which had previously been derived from it, prompted the carriers to make a thorough study of the situation with a view to establishing a rate that would aid in recovering some of the traffic. Numerous conferences with automobile manufacturers and dealers brought about the rate of 50 cents, which does not include store-door delivery.

In protesting against the application, the intervening trucking lines said the rail rate of 50 cents had compelled them to make arrangements with labor resulting in a lower wage and to extend their services to points other than Chicago. They contended that the relief sought was a violation of the long-and-short-haul section and contrary to the policy of the Transportation and Motor Carrier Acts. The commission held against these views and granted the relief on the basis of its constituting a special case which warranted granting of the relief asked. It was stated that the movement of automobiles to Chicago from the places of origin concerned is subject to more intensive truck competition than affects the movement of like traffic from the same origins to destinations beyond Chicago.



Cars arriving at San Francisco by rail are unloaded in this special station having a capacity of 250 vehicles a day.

GOP Asked to Support Reciprocity

Macauley, Speaking for Industry, Urges Republicans to Adopt Foreign Trade Expansion Plank

In order that the tariff issue may take its place as a non-partisan economic question, delegates to the Republican National Convention were requested last week in a statement signed by Alvan Macauley, president of the Automobile Manufacturers Association, to write into the platform of that party a plank approving the principles of reciprocal trade agreements with foreign countries. The Democratic Party already is on record.

Serving the needs of the nation as a whole, the policy of negotiating reciprocal trade agreements was held, in the communication to the Republicans, to promote not only a two-way expansion of foreign commerce but also to benefit domestic production and employment.

The automobile industry stated the belief that:

"The export of American manufactured goods should be maintained for the direct and positive advantages that such exports provide,

"The export of American agricultural surpluses should be promoted, so that the farmer may raise more and sell more, and become, in consequence, a better customer for manufactured goods in the United States, with a higher standard of living,

"The import of goods into the United States should be promoted on a competitive basis so that the customer may benefit and so that adequate dollar exchange may be created for our vitally important exports," and that

"The reciprocal lowering of tariffs is necessary to these ends."

The statement was based upon the recommendation of the Export Managers' Committee and is the result of action by the Board of Directors, composed of the following officials of the automobile industry:

A. Edward Barit, president, Hudson Motor Car Co.; R. F. Black, president, the White Motor Co.; A. J. Brosseau, president, Mack Trucks, Inc.; Walter P. Chrysler, chairman of board, Chrysler Corp.; Byron C. Foy, president, DeSoto Motor Corp.; Robert C. Graham, vice-president, Graham-Paige Motors Corp.; Paul G. Hoffman, president, the Studebaker Corp.; Alvan Macauley, president, Packard Motor Car Co.; W. F. McAfee, International Harvester Co.; Charles W. Nash, chairman of board, the Nash Motors Co.; Alfred P. Sloan, Jr., president, General Motors Corp.; Alfred H. Swayne, vice-president, General Motors Corp.

"The automobile industry," the statement said, "believes in a rational protective tariff policy, but maintains the view that the tariff policy of the United States should be in harmony

with sound economic principles, and predicated upon the two-way expansion of our foreign commerce.

"The problems of world trade today, and the relationship of the United States to these problems, are probably more complicated than at any time in our history. With the growth abroad of stringent trade restrictions and exchange controls, it becomes more apparent that the conditions under which the agriculture and the industry of the United States must engage in foreign trade are not of static nature. More than ever before, the maintenance and development of foreign markets for American products depends upon the enlightened principles embodied in the negotiation of reciprocal trade agreements.

"The automobile industry supports the negotiation of trade agreements with foreign countries because it is through reciprocal agreements that restrictions of free economic trade may be gradually lessened and our foreign markets more fully restored."

Detroit Sub-Committee of AMA Safety Group Formed

With R. P. Foley, secretary of the Chrysler Corp., as chairman, organization of a Detroit sub-committee of the Safety Traffic Committee of the Automobile Manufacturers Association was announced this week by Paul G. Hoffman, president of the Studebaker Corp. and chairman of the committee.

Other members of the committee to serve with Mr. Fohey are: Ralph L. Lee, research department, General Motors Corp.; Robert Waldron, personnel department, Hudson Motor Car Co.; A. G. Dennison, public relations department, Packard Motor Car Co.; W. J. Cronin, Automobile Manufacturers Association, Detroit, and Norman Damon, secretary, Safety Traffic Committee, Automobile Manufacturers Association.

The Detroit sub-committee will work in cooperation with public officials and safety bodies in Detroit, Michigan, and the Mid-West in the nation-wide movement for greater safety on the highways.

Banigan Joins Edison Staff as Merchandiser

Leon F. Banigan, for 16 years editor of *Motor World Wholesale* and other Chilton publications, will join the executive staff of the Edison-Splitdorf Corp. on June 15 as merchandising director, according to an announcement made this week by A. J. Clark, vice-president and general manager. The company, with headquarters in West Orange, N. J., is a subsidiary of Thomas A. Edison, Inc., and manufactures spark plugs, magnetos and spark coils.

In making the announcement, Mr. Clark stated that the appointment enabled the Edison-Splitdorf Corp. to expand its policy of cooperating closely with its distributing outlets. In his new work, Mr. Banigan will be in close touch with the sales and advertising departments and will also work directly with wholesalers and retailers, assisting with their selling programs.

Leon F. Banigan

"Ban," as he has become known to hundreds of warm friends in the automotive industry, has acquired an outstanding reputation as a marketing authority. Only recently, he completed a thorough investigation into the marketing of automotive products, and during his 16 years in the business paper field he has editorially pioneered fundamental wholesaling ideas that have influenced many trends in jobber management policies.

Ford Reports Small Profit

Earnings for 1935 of $3,565,617 Are Indicated by Balance Sheet; Nearly Doubled in 1934

Based solely on the balance sheet filed with the Massachusetts Commissioner of Corporations, net earnings of the Ford Motor Car Co. for 1935 appear to have totaled $3,565,617. Of this amount, $2,701,259 was shown in an increase in the profit and loss account, and $864,358 represented the gain in reserves. The total compares with an indicated profit in 1934, computed in similar manner, of $6,860,462.

Considerable emphasis has been placed on the fact that Ford production for 1935 increased upwards of 70 per cent over 1934 and in making comparisons with previous years, it must be remembered that the Ford balance sheet does not make provision for dividend payments to stockholders, which constitute only the Ford family, nor is provision made for charges against surplus or for adjustments in the property account.

The capital stock of the company remains at $17,264,000 despite the change from $100 to $5 par value made two years ago, and as usual the great bulk of the Ford enterprise is shown in the profit and loss account which this year totals $582,977,651. The balance sheets, submitted for the last three years are given and also a comparison of the profit and loss accounts for each year since 1921.

The balance sheet appears on this page with the profit and loss account.

Balance Sheets of the Ford Motor Car Co.

Assets

	1935	1934	1933
Real estate	$151,004,515	$144,958,979	$150,912,504
Mach., equip., etc.	91,536,808	82,811,704	90,112,502
Inventory	68,568,702	63,634,223	48,537,414
*Cash, etc	377,310,316	361,667,154	343,304,237
Deferred charges	3,129,588	4,093,500	6,239,168
Total	$681,549,929	$657,165,560	$639,105,825

Liabilities

Capital stock	$17,264,500	$17,264,500	$17,264,500
Accts. payable, etc.	70,346,432	49,527,680	38,328,408
Reserves, etc.	10,961,346	10,096,989	6,995,838
P & L surplus	582,977,651	580,276,391	576,517,079
Total	$681,549,929	$657,165,560	$639,105,825

* Includes accounts and notes receivable, securities patent right, trademarks, etc.

Profit and Loss Account

Years to	Total	Profits	*Per Shr.
Dec. 31, 1935	$582,977,651	$3,565,617	$1.03
Dec. 31, 1934	580,276,392	6,860,462	1.98
Dec. 31, 1933	576,517,079	† 3,480,331	...
Dec. 31, 1932	580,440,603	† 79,247,669	...
Dec. 31, 1931	655,302,247	† 53,586,000	...
Dec. 31, 1930	708,888,247	44,460,823	257.00
Dec. 31, 1929	664,427,424	81,797,861	473.00
Dec. 31, 1928	582,629,563	† 72,221,498	...
Dec. 31, 1927	654,851,061	† 42,786,727	...
Dec. 31, 1926	697,637,788	75,270,895	436.00
Dec. 31, 1925	622,366,893	115,078,383	666.00
Dec. 31, 1924	542,476,497	115,105,416	667.00
Dec. 31, 1923	442,041,081	‡ 82,263,483	476.00
Feb. 28, 1923	359,777,598	119,298,862	691.00
Feb. 28, 1922	240,478,736	‡ 57,601,040	334.00
Apr. 30, 1921	182,877,696	‡ 17,198,564	100.00

* $5 par stock in 1935 and 1934; previous years $100 par. † Loss. ‡ Ten months.

Architect's drawing of the new raceway to be built near Roosevelt Field, Long Island.

Roosevelt Raceways

With no limit on gasoline or total weight and superchargers permitted, the "First Annual 400-Mile International Sweepstakes," to be held at the new Roosevelt Raceway on Long Island, Oct. 12, is expected to draw many European as well as American entrants.

In addition to the unusually broad limits, the specifications recently announced by the contest board of the American Automobile Association prohibit the riding mechanic and require a compulsory pit stop between the 160th and 240th miles for inspection by the A.A.A. technical committee. The prize purse will total $50,000, plus consolation prizes of $10,000.

The new Roosevelt Raceway features a straightaway 3775 ft. long in addition to 20 curves and 14 other straightaways, one as short as 125 ft. Grandstands seating approximately 50,000 people will flank the main stretch in addition to smaller stands at strategic points.

Motor Developement Corp., of which George P. Marshall is president, is the sponsor of the track, and races will be under the management of George Robertson, winner of the Vanderbilt Cup race held on Long Island years ago.

Goodyear Workers Arrested Following Labor Agitation

Labor strife which has kept the Akron tire industry in a state of turmoil for many weeks with almost daily sit-down strikes of rubber workers in major factories, were climaxed May 24 with the arrest of 30 Goodyear unionist employees on warrants charging them with violating Ohio's riot act, by inciting riot. The arrests were the direct aftermath of a major sit-down strike which had completely closed Plant 2 at Goodyear. Goodyear officials claim unionist employees virtually seized the plant, herding foremen and other officials into a hurriedly improvised bullpen and keeping them as hostages for nearly 12 hours. The plant shut down affected 7000 employees.

On May 21, Lyle Carruthers and Russell Moats, two Goodyear non-union employees, were attacked by a group of men in Goodyear Plant 2. As a result, three Goodyear unionists are under arrest and facing trial on assault and battery charges.

The arrest of the 30 Goodyear unionists was the signal for a new sit-down at Plant 2, which kept the plant from opening after the week-end holiday until Monday morning. When arraigned in court, the 30 secured a postponement of arraignment until legal counsel from the Civil Liberties Union could be obtained. All 30 have demanded jury trials.

Leaders of the United Rubberworkers Union of America have appealed to Government officials at Washington to investigate their charges of alleged "practices of espionage" on the part of Akron tire company officials.

Meanwhile major Akron tire manufacturers are pushing their plans to decentralize the industry by establishing new factories outside of Ohio, and by transferring equipment to their various subsidiary plants.

Mallory Opens Branch Warehouse in Detroit

P. R. Mallory & Co., of Indianapolis, held open house this week to signalize the opening of its new factory branch in Detroit. The company has acquired the entire building at 2449 East Grand Boulevard, Detroit, to house its regional sales offices as well as a completely stocked warehouse which will carry Mallory alloys for welding tools, tips, and Mallory 3 metal for welding machine parts. John D. Tebben, Detroit manager, will be in charge of the new plant.

NSPA-MEWA File Denial Of FTC "Unfair" Charges

On May 25 the Motor and Equipment Wholesale Association filed complete denial of the charges made by the Federal Trade Commission in April which accused both this organization and the National Standard Parts Association of price-fixing, boycotting and other violations of law. The denial of the M.E.W.A. followed a similar denial of the N.S.P.A. filed three weeks ago.

In both cases, the associations point out the number of members in each association, and deny the monopolistic

inference of the F.T.C. The N.S.P.A. further points out that it is not incorporated as the commission charged. Many of the individual member companies, which were also charged with violations, pointed out that they had always been faced with price competition, and that they had taken means to meet it, despite published price schedules.

The hearing, originally scheduled for May 22, was postponed until June 5 at the request of the associations involved.

Uniform Standards For Fuels And Lubricants

A program of specifications and tests to secure more uniform qualities in motor fuels and lubricants has been launched by the American Standards Association, in cooperation with other organizations. T. A. Boyd, head of the fuel section of General Motors, is chairman of the committee for technical requirements and R. E. Hess of the American Society of Testing Materials, is its secretary.

In connection with the need for such a program, the Transit Association has pointed out the difficulty which fleet operators encounter in getting uniform quality on the road, and it has also been pointed out that while most modern cars provide the means of adjustment for any specific fuel, it is not practical to continually change the setting for the various qualities of fuel which are encountered.

Safety Cushion Bumper And Mfg. Co. Organized

Announcement is made of the organization of the Safety Cushion Bumper & Manufacturing Co., in Detroit, with a capitalization of $75,000, by a group headed by Samuel B. Collier. Plant space of 10,000 sq. ft. has been acquired.

Experimental production has been limited to the equipping of taxicabs in Detroit. National distribution to commercial fleets will be first on the program of the company.

Micromatic Builds Addition

Micromatic Hone Corp. has just announced completion of a new addition to its Detroit plant which doubles floor space. Herbert J. Woodall has recently been elected to the board of directors of this company.

Japan Tries Charcoal Burners

Tiny Datsun to Have Gas Generator; Power Cost Said to Be Half That of Gasoline

Special to Automotive Industries

Following the examples of Germany and Italy in an effort to become independent of foreign fuel supplies, Japan is soon to have a charcoal burning automobile. The Mitsubishi Heavy Industries Co. announces that it plans to equip its small Datsun passenger car with charcoal gas generators. (Description of the Datsun appeared in AUTOMOTIVE INDUSTRIES, Jan. 11, 1936, page 34.)

Of Japan's total gasoline consumption only eight per cent is of domestic production, the balance is imported. Some time ago the Ministry of Commerce and Industry, the Fuel Research Institute, and other bodies began cooperating with automobile manufacturers to increase the utilization of charcoal in automobiles.

Japan produces annually some 500,000,000 kwan of charcoal, has a decreasing demand for it, and is facing overproduction. (A kwan equals 8.27 lb. or 3.75 kilog.) A kwan of charcoal costs only 22 sen (6 cents approximately), and is said to equal in motor power one gallon of gasoline which is priced in Japan at 46 sen. The cost of charcoal fuel would therefore be half that of gasoline.

It is understood that if the price of gasoline is raised further in the future, industrialization of coal liquefication and the application of alcohol as a substitute for gasoline will be made the main basis of fuel supply in Japan. The placing of charcoal burning automobiles on a practical basis is regarded as economically favorable to agrarian and fishing villages.

Truck Operator Test Case Heard by ICC in Chicago

This week in Chicago the Interstate Commerce Commission sought to find the answer to one of the knottiest problems which the Motor Carrier Act, 1935, has presented. The commission has repeatedly professed ignorance as to the proper classification of cartage operators, and the hearing conducted before a Joint Board was for the purpose of finding an answer to that question.

Basically, it was in the matter of the petitions filed by E. P. McNeil, doing business as George McNeil Teaming Co., for application for a certificate as a common carrier in Chicago and a radius of 100 miles out of Chicago. Petition for a permit as contract carrier in commodities over five routes in interstate operation had also been filed.

The hearing was to settle interpretation of Section 210 of the Act. This section specifies that no carrier is to be permitted to "engage both as common and contract carrier over the same routes unless the Interstate Commerce Commission feels that he can show good cause that it is consistent for the commission to grant such a permit." The commission is to be guided by "public convenience and necessity."

Testimony was presented by Mr. McNeil who declared that his concern was always seeking business from shippers where he could receive compensatory rates. He said that about 50 per cent of his equipment was under lease to contract shippers, and that about 95 per cent was engaged in cartage operation in the corporate city of Chicago. He told also that his operation was almost parallel with the operation of every other concern engaged in cartage hauling.

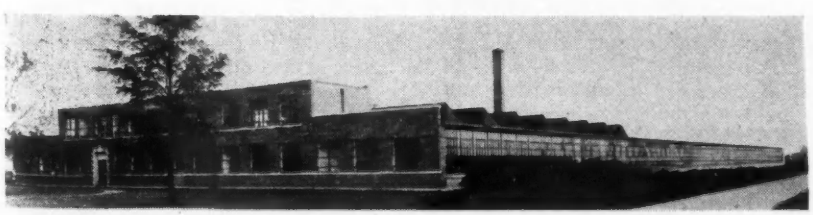
At the outset of the hearing, the chairman explained that the extent of authority of the board was not definitely prescribed, and intimated that the case might not be finally disposed of until it had been carried through to the Supreme Court. It was on this assumption that various exceptions to testimony and objections were taken.

Bantam Again Expands Its South Bend Plant

The Bantam Ball Bearing Co. is adding new machinery and building an addition to its plant at South Bend at a cost of $250,000. This new expansion gives an additional area slightly greater than the addition which was built last year and gave the factory a 60 per cent increase in floor space.

At the time of last year's expansion it was anticipated that the floor space added at that time would care for the company's needs for several years to come, but the increase in business has been so great that the company has had to provide additional plant and equipment facilities.

The Bantam company manufactures both roller and ball bearings in the South Bend plant in sizes ranging from 1/32 in. to 60 in. in diameter.



The Bantam Ball Bearing Co.'s plant in South Bend.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES

General business activity was well maintained last week, and one business activity index registered a new high for the current movement. Some observers are of the opinion that the upward trend in trade will continue well into the summer. One estimate places the level of retail sales for the entire country at from 8 to 12 per cent above that in the corresponding period last year. The large crops in most sections are reported to be in good condition. There has been very little rain in the Southeast, and the drought has been intensified. Conditions are reported to be critical in some areas, and the minor crops have deteriorated further.

Business Better

The index of business activity compiled by the Guaranty Trust Co. for April stood at 82.9, as compared with 76.8 the month before and 71.5 a year ago. The company's index of wholesale commodity prices was 53.3 on May 15, as against 54.5 a month earlier and 54.2 a year earlier. The figure for this month appears to represent a continuation of the virtually horizontal trend maintained since the middle of 1933.

Electric Output Well Above Year Ago

Production of electricity by the electric light and power industry in the United States during the week ended May 16 was 15.4 per cent above that in the corresponding period last year.

Carloadings Gain

Railway freight loadings during the week ended May 16 totaled 681,447 cars, which marks a gain of 12,512 cars above those in the preceding week, a rise of 98,497 cars above those a year ago, and an increase of 69,116 cars above those two years ago.

Building Level Highest Since 1931

Construction contracts awarded in 37 eastern states during April amounted to $234,806,300, which is the highest level for any month since October, 1931. This figure compares with $198,978,300 for March and only $124,020,000 for April, 1935. All major branches of the construction industry shared in the improvement, but non-residential and heavy engineering projects made the best percentage gains.

Fisher's Index

Professor Fisher's index of wholesale commodity prices for the week ended May 23 stood at 80.5, as compared with 81.0 the week before and 81.6 two weeks before.

Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended May 20 showed no changes in holdings of discounted bills, bills bought in the open market, and Government securities. Money in circulation increased $8,000,000, and the monetary gold stock rose $73,000,000.

Stephen A. Ingersoll

Stephen A. Ingersoll, who for more than 50 years had been actively identified with the farm implement and automotive industries, died on May 15 at his home in Galesburg, Ill.

Born on April 27, 1858, Mr. Ingersoll founded in 1884 the Sandoval Mfg. Co., of Sandoval, Ill. This company was later moved to Galesburg, Ill., and the name changed to Galesburg Coulter-Disc Co. In this plant, Mr. Ingersoll originated and perfected the first electric heat-treating process as applied to discs and coulter-blades for farm implements.

The Indian Rolling Mill Co., New Castle, Ind., and the Chicago Rolling Mills, Inc., were later acquired by the company, and the name became Ingersoll Steel & Disc Co., which is now a division of Borg-Warner Corp.

Mr. Ingersoll's son, Roy C., is president of the division and two other sons, Harold G. and Stephen L., as well as a son-in-law, Arvid P. Zetterberg, are also associated with the company.

General Motors to Exhibit At Texas Centennial Fair

Alfred P. Sloan, Jr., president of General Motors Corp., announced today that General Motors will participate in the Texas Centennial Exposition at Dallas from June 6 to Nov. 29, with an exhibit of progress in automotive and allied fields, completely housed in a separate building to be known as the General Motors Auditorium.

"In our decision to participate in the Texas Centennial Exposition at Dallas, we have been prompted by the desire to emphasize to the people of the southwestern states the importance of the developments of science and research during the past few years," said Mr. Sloan. "Industry did not call a halt on progress during the depression years. On the contrary, it continued to seek new methods and new and better products, believing that by so doing costs would be reduced and the volume of distribution increased, with more jobs and higher standards of living for all."

The products of General Motors and its various subsidiaries and affiliated companies will be on display along with exhibits of the General Motors Research Laboratories in the General Motors Auditorium.

In the main exhibition hall, motor cars will be on display, representative showings of Chevrolet, Pontiac, Oldsmobile, Buick, LaSalle and Cadillac. The four cars grouped around the centerpiece are finished in blue bonnet blue, the color of the state flower of Texas. Also in the main exhibition hall is the famous General Motors safety car which illustrates the safety features common to all General Motors cars by means of metal panels, about the size of an automobile license plate, which automatically shoot out from the car. There is also a Chevrolet chassis which shows the parts of the car supplied by General Motors parts and accessories divisions.

Chain Store Tax Showed Oil Company Way to More Profits

The chain store tax which forced Standard Oil of Indiana and many other oil companies out of the company owned and operated service station field in Iowa a year ago is proving a boon in that leases have been made to individuals are paying bigger returns to the company. Edward G. Seubert, president of Standard Oil of Indiana, reviewed the situation at the annual stockholders' meeting recently.

"We expect shortly," declared Mr. Seubert, "to take steps toward leasing many of our company owned and operated stations in Indiana, Wisconsin and Colorado.

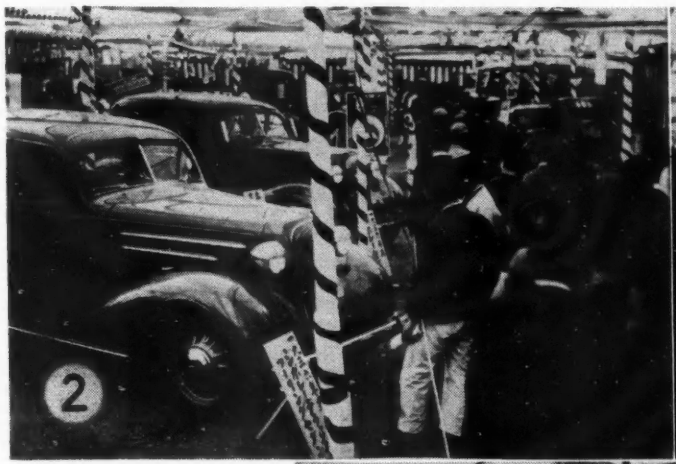
40 Years Ago

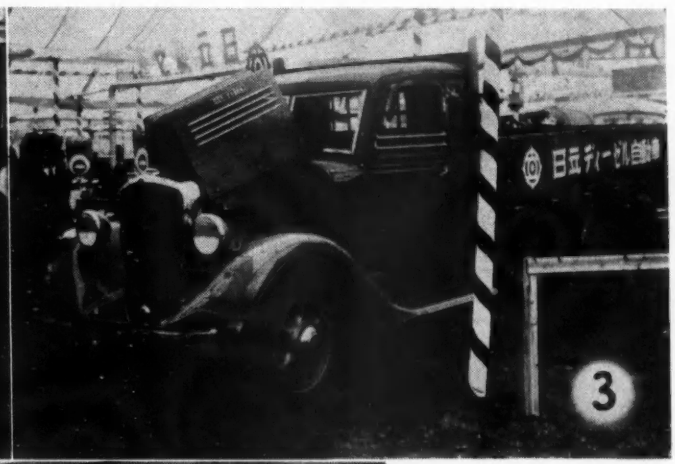
with the ancestors of AUTOMOTIVE INDUSTRIES

The aldermen of New York on Tuesday, May 26, refused permission to John Brisben Walker to hold a parade of motor carriages through the streets of New York on Decoration Day, on the ground that it would interfere with the parade of the Grand Army veterans, who still wield a considerable political influence. The demonstration must therefore begin at High Bridge and end there.—From *The Horseless Age*, May, 1896.

Domei photos.

The WORLD on WHEELS





1. The Sumida truck chassis, manufacture of which is subsidized by the military authorites is shown at the Japanese Industrial Exposition sponsored by the Tokyo newspaper, *Jiji Shimpo*

2. American cars are shown at the International Automobile Show in Hibiya Park, Tokyo

3. The Hitachi truck is powered by a Diesel engine giving 30 hp. at 1800 r.p.m. and sells for 10,500 yen ($3,070)

4. Latest model bus body produced by the Kyodo Jidosha Kokusan (United Domestic Motorcar Co., Ltd.)

5. The Nippon Aircraft Mfg. Co. has begun mass production of the Japanese version of the French "Flying Flea." It is powered by a 20 hp. Auvière Dune engine and will sell for about 4000 yen ($1170)

April Production Sets New Mark

Is Highest Peak Since August, 1929; Trucks Surpass Cars in Gain for First Four Months

Passing the half-million mark for the first time since August, 1929, car and truck production in the United States and Canada reached 527,726 units during April. While passenger car production was 22 per cent ahead of the previous month and seven per cent above April, 1935, truck production was only six per cent above March, but 30 per cent over April a year ago. Thus, at the end of the first four months, passenger car production showed a gain of but 3 per cent, while truck production had increased 14 per cent over the previous year.

United States shipments to foreign outlets increased slightly for the first four months, but Canadian production of cars and trucks fell six per cent.

The accompanying table, based on figures released by the Bureau of the Census, Department of Commerce, shows a detailed analysis of the production figures:

Passenger Car and Truck Production—U. S. and Canada

	April, 1936	March, 1936	April, 1935	First Four Months 1936	First Four Months 1935
Passenger Cars—U. S. and Canada:					
Domestic Market—U. S.	395,182	323,238	367,538	1,204,069	1,171,062
Foreign Market—U. S.	21,951	20,285	19,620	79,677	76,636
Canada	20,247	14,488	20,688	56,849	61,021
Total	437,380	358,011	407,846	1,340,595	1,308,719
Trucks—U. S. and Canada:					
Domestic Market—U. S.	74,363	65,496	56,194	245,696	215,456
Foreign Market—U. S.	11,279	11,952	9,584	45,914	37,654
Canada	4,704	3,486	3,435	12,646	13,798
Total	90,346	80,934	69,213	304,256	266,908
Total—Domestic Market—U. S.	469,545	388,734	423,732	1,449,765	1,386,518
Total—Foreign Market—U. S.	33,230	32,237	29,204	125,591	114,290
Total—Canada	24,951	17,974	24,123	69,495	74,819
Total Cars and Trucks—U. S. and Canada	527,726	438,945	477,059	1,644,851	1,575,627

Revised Passenger Car and Truck Production

(U. S. and Canada)

1936	Passenger Cars	Trucks	Total Motor Vehicles
January	309,535	67,771	377,306
February	235,669	65,205	300,874
March	358,011	80,934	438,945
Total	903,215	213,910	1,117,125
1935			
January	235,823	64,512	300,335
February	287,461	62,884	350,345
March	377,589	70,299	447,888
April	407,846	69,213	477,059
May	322,577	59,232	381,809
June	306,458	65,627	372,085
July	283,815	61,363	345,178
August	186,654	58,438	245,092
September	59,916	32,947	92,863
October	220,438	59,918	280,356
November	348,956	59,599	408,555
December	354,392	63,911	418,303
Total	3,391,925	727,943	4,119,868

Lubrication Patents Held Not Infringed

A 10-year litigation over alleged infringement of the Gullborg lubrication fitting patents resulted in a Supreme Court decision on May 18 holding that devices made by the R. M. Hollingshead Co., Camden, N. J., were not "contributory infringements" of devices for which patents are held by the Bassick Mfg. Co., which, with the Alemite Corp., is a subsidiary of Stewart-Warner.

General reductions have been effected, it is understood, on the price to distributors of Alemite fittings, but officials of Alemite were non-commital over the decision. It was said that the patents on the fittings expire next month, and that the courts' opinion will bear little or no direct effect because of this. An official of Alemite division declared that the company does not consider the decision as being "at all adverse."

Ammco Buys Hempy-Cooper

The Automotive Maintenance Machinery Co. (AMMCO) of North Chicago, has just completed the purchase of the Hempy-Cooper Mfg. Co. of Kansas City, Mo. With this purchase the Hempy-Cooper Co. has been completely liquidated and their inventory of raw materials, finished products, jigs, and fixtures have been moved to the AMMCO factory.

AMMCO will continue the manufacture of part of the Hempy-Cooper line, which will be incorporated in their own line of Tools and Machines.

Hudson Local Votes Merger With A.F.L. International

Eighty per cent of the membership of the Hudson local of the Associated Automobile Workers of America voted in favor of the merger with the A. F. of L.'s United Automobile Workers International Union, or considerably in excess of the two-thirds vote required. A committee was to meet Thursday evening to make final arrangements for consolidation, which it was hoped would become effective either June 15 or July 1. Just how many of the 20 per cent who voted to postpone the merger will go along with the majority is a question. No initiation fee is being charged, but monthly dues in the U.A.W. will be $1, as against 50 cents collected by the A.A.W.A.

Returns are not all in from the Automotive Industrial Workers Association, but early this week eight of the 26 locals had reported favorably on amalgamation. Only 11 votes of 8000 cast are said to have opposed it, and it was predicted by officials that the merger would go through with a big favorable vote.

May Sales Near April's Peak

(Continued from page 747)

Both new and used car stocks are on the down-grade. In fact, liquidation of new car inventories got under way in April when passenger car stocks declined about 3000 units to just under 400,000. Reduction in used car stocks did not start until May, but good headway is now being made as sales continue to expand at a good rate.

Deprived of model change stimulus, the used car business is more closely tied to the seasons, and sales executives are more than ever convinced that they must make hay while the sun shines. For that reason they are urging that dealers add manpower to their used car departments at this time and the effect of enlarged selling forces is already manifest in the rapidly rising sales.

Throughout the industry there is an easier feeling with respect to the used car situation, which now appears to be well in hand, despite the return of the Ford Motor Co. and some of its branches to a four-day schedule last week. The industry's May production is still expected to border on the half-million mark, with only a moderate decline indicated for June.

Buick retail sales for the second 10 days of May amounted to 5549 units, a gain of 13 per cent over the first 10 days and 142 per cent above the same

period last year. Total sales during the eight months since the 1936 models were announced aggregate 102,712 units, more than the entire 12 months' production of any year since 1930.

The United States Army has placed an order with Northwest Motor Co., Ford dealer of Chevy Chase, Md., for 112 ambulances comprising the 131-in. Ford truck chassis and a panel body constructed in accordance with army specifications for ambulance service.

Studebaker factory sales for the first 20 days of May totaled 5207 units, compared with 3193 for the same 20 days a year ago—an increase of 63 per cent. Total sales for 1936 amount to 36,510 units and compare with 23,502 units produced in the same period of 1935.

ANKER K. ANTONSEN has resigned his position as chief designer at the Fairbanks, Morse & Co. plant at Beloit, Wis. His present residence is Skaneateles, N. Y.

GEORGE H. FREERS has been appointed chief engineer in charge of all Pak-Age-Car activities of the Stutz Motor Car Co. Mr. Freers is a graduate of the Rose Polytechnic Institute and has served in the engineering departments of the Interstate Automobile Co., U. S. Motors, Packard, and the Marmon.

JULIUS KAHN, who has been president since the founding of Truscon Steel Corp. 33 years ago, has resigned to become vice-president in charge of product development of Republic Steel Corp., Cleveland.

FORREST H. RAMAGE has been promoted from assistant manager of the advertising and sales promotion division to sales promotion manager of Republic Steel Corp., Cleveland.

STANLEY A. KNISELY, formerly manager of the advertising and sales promotion division of Republic Steel Corp., has been named director of advertising in charge of all advertising of the corporation and its subsidiaries.

SOL EINSTEIN has been elected a vice-president of the Cincinnati Milling Machine Co. Mr. Einstein started in 1903 as a tracer with the company, becoming next a detailer and designer, and rose to the position of chief engineer which he has held since 1920.

GEORGE O. O'HARA has joined the sales department of the Detroit Electric Furnace Co. Since 1930 he has been with the Electrode division of Republic Carbon Co. and its successor, National Carbon Co.

ALBERT A. JONES has resigned as vice-president in charge of manufacturing of International Harvester Co., on account of ill health. **C. R. McDONALD** has been placed in charge of the manufacturing department. Mr. McDonald has been with the Harvester Company and one of its predecessors, the Plano Manufacturing Co., for 41 years.

W. J. PARKER, commissioner of the National Battery Manufacturers Association, has been elected president of the Trade Association Executives in New York.

ATA Wins Rail Pick-Up Suspension

Railways' Trucking Operations Subject to Motor Carrier Act, It Is Argued

By a quick reversal, the Interstate Commerce Commission last week, by a six to five vote, suspended eastern district railroad pick-up and delivery tariffs, which were to have become effective May 25. On Friday the commission had voted not to suspend the tariffs. The decision to suspend the tariffs was based on a petition of the American Trucking Associations, Inc., which asked for reconsideration of the order of May 21 directing the tariffs to go into effect.

Strongly opposed to the railroad pick-up and delivery tariffs from the outset, the A.T.A. in its latest petition for reconsideration, declared that "it is obvious that there is in some quarters a total misconception of the issues involved" or else "propaganda is being disseminated for the purpose of obscuring the real issues."

The A.T.A. petition, referring to a petition of the Shippers' Conference of Greater New York, favoring the tariffs, said: "It is clear they are arguing for the general proposition of pick-up and delivery of freight moving by rail and ostensibly on the theory that someone is opposed to pick-up and delivery. We know of no one who is trying to deprive the shipping public of pick-up and delivery service." The A.T.A. added that it has never asked the I.C.C. to do more than require railroads to comply with Motor Carrier Act with respect to any and all motor carrier operations and proper charges for them.

The A.T.A. contends that transportation "wholly by railroad" within the meaning of the Interstate Commerce act, begins and ends on rail; that any transportation by motor vehicle is a separate business which never was and is not now subject to that act, but is subject entirely and exclusively to the Motor Carrier Act. It was stated that there can be no motor carrier service by railroads or railroad agents unless there be held by railroads, certificates of convenience and necessity under the Motor Carrier Act; that any certified common carrier motor carrier performing such service in connection with a railroad can only do so under a joint tariff or concurrence; that motor carrier services must be based on a separate and adequate charge; that the legal issues have nothing to do with whether the shipping public should have the benefits of collection and delivery service or any other service by motor vehicle, but the issues are whether the railroads are to comply with the law when they offer such services.

Meanwhile competition between motor buses and railroads will become sharper as the result of the rapid move of the Greyhound, Blue Ridge, Great Eastern, Short Line and Safeway Trailways which have announced, effective June 1, cuts in rates to as low as one and one-half cents per mile to meet the reduced railroad passenger fares of two cents per mile. The passenger fare cut was ordered by the Interstate Commerce Commission and is the object of court contest inaugurated by all the major Eastern railroads, except the Baltimore & Ohio.

While the proposed bus rate reductions are described as "tentative," officials of the National Association of Motor Bus Operators have stated that schedules are being drafted by the principal bus lines in the East carrying rates ranging from one and one-half to one and three-quarter cents per mile. They will also grant a 10 per cent fare reduction for round trips.

New Motor Wage Peak

April Payrolls Highest Since 1929; Weekly Average Is $32

Automobile manufacturing plants last month paid out the highest weekly payrolls since 1929.

The April record figure was $11,600,000 a week, an average of $32 per employee. This compares with an all-time peak for the automobile industry of $35 in the spring of 1929. The current average for all manufacturing industry is only $22—about two-thirds of the automobile average.

This new wage peak in the automobile industry was the product of high hourly earnings and steady employment. Recent average work-hours per week were 10 per cent below those of the peak of 1929 and approximately unchanged from the spring of 1935.

Since official figures of the United States Department of Labor and State Labor Offices show the current cost of living in automobile cities to be more than 20 per cent below 1929 average levels, the average wages paid automobile workers in April of this year had a purchasing power greater than ever before.

April employment reports showed continued stability in number of men at work which has been manifest since the beginning of 1936 production. The total of employees was 363,000, approximately equal to the average for the elapsed 1936 model production period (November, 1935, through April, 1936, inclusive).

This figure, as well as the earnings reported above, refers exclusively to the automobile and truck assembly, and body manufacturing plants.

Truck and Trailer Size and Weight Restrictions, by states. A handy reference booklet recently published by the Research Dept. of the Four Wheel Drive Auto Co., Clintonville, Wis. Gratis. Copies available through AUTOMOTIVE INDUSTRIES.

How to Protect Business Ideas by William H. Leahy. Published by Harper & Brothers, New York, N. Y. A study of trade marks, patents, copyrights, labels and kindred properties. Price $2.50.

New uses for **Silcrom Steel** is the subject of a new and extremely well designed booklet by Ludlum Steel Co., Watervliet, N. Y.

Effects of Air-Fuel Ratio on Fuel Spray and Flame Formation in a Compression-Ignition Engine, by A. M. Rothrock and C. D. Waldron. Report No. 545 of the National Advisory Committee for Aeronautics. For sale by the Superintendent of Documents, Washington, D. C. (5 cents).

Combustion-Engine Temperatures by the Sodium Line-Reversal Method, by Maurice J. Brevoort, Langley Memorial Aeronautical Laboratory. Technical Note No. 559 of the National Advisory Committee for Aeronautics, Washington, D. C.

Many suggestions on installing **piston rings,** including proper types to use for all degrees of engine wear, is the contents of a handy booklet distributed free to the service trade by Hastings Mfg. Co.

Miniature CHECK-CHART, Vol. 2, containing lubrication charts for all 1935-1936 cars. A 5½ by 7¾ in. edition intended to supplement regular working charts . . . Sold only to service stations using regular CHECK-CHARTS, but may be purchased by refiners and equipment houses for the use of salesmen. Available from Check Chart Corp., 624 S. Michigan Ave., Chicago. Single copy price, $3.00.

"Some Facts About the Chrysler Corp." is the title of an interesting booklet giving facts about the corporation's products, plants, production, exports, sales, distribution of earnings, etc. Copies available from AUTOMOTIVE INDUSTRIES.

Thermometer Catalog, No. 1250, by Bristol Co., is in the form of an 88-page engineering handbook giving 500 temperature recording charts and full discussion of all types of modern thermometers. Copies available from AUTOMOTIVE INDUSTRIES.

Index to **A.S.T.M. Standards,** published by the American Society for Testing Materials, 260 S. Broad Street, Philadelphia, Pa.

Colloidal Graphite and its Varied Uses in the Automotive Industry, published by Acheson Colloids Corporation, Port Huron, Mich.

Tin and Civilization, by D. J. Macnaughtan, director of research. Published by International Tin Research and Development Council, 149 Broadway, New York, N. Y.

Tin and its Uses, by D. J. Macnaughtan, director of research. Published by International Tin Research and Development Council, 149 Broadway, New York, N. Y. Publications received

The **Goodrich Redbook,** a catalog of all Goodrich products and sales helps for the tire, battery and accessory dealer. Published by the B. F. Goodrich Co., Akron, Ohio.

Automotive Metal Markets

Steel Price Advance of $2 per Ton Fails to Bring Rush of Third Quarter Covering from Motor Plants

By William Crawford Hirsch

Finished steel producers let it be formally known on Monday that they would advance third quarter prices of sheets and strip steel $2 a net ton. Steel bars for third quarter shipment were also marked up $2 a net ton. An unconfirmed report has it that in the case of automobile sheets, extras would come in for some downward revision to offset in part the $2 advance.

Announcement of the price increase in finished steel descriptions followed one of $2 per gross ton in semi-finished steel, of which one of the leading interest's subsidiaries gave notice late last week. In some quarters it was intimated that the motive in giving notice at this time of higher third quarter steel prices was to afford to automobile manufacturers an opportunity to take this higher cost factor into full consideration before announcing their 1937 model selling prices.

While a price advance has been spoken of as a possibility for some time, the reception accorded recent Wall Street predictions to that effect in the steel market was such that many automotive consumers doubted it would come to pass. In fact, all of the steel industry's organs expressed doubt that a horizontal advance of this sort would be attempted at this time.

It is now pointed out that the step taken by the producers shows that since one of the "independents" announced quantity differentials last month and took the leadership in eliminating concessions, the market has been stabilized and that this made possible the advance in prices scheduled for the next quarter. On the other hand, the higher price levels must first endure the test at a time of the year when, in the opinion of many, consumers' needs will not be as great or as urgent as they were in the second quarter.

To what extent automotive consumers will seek to anticipate part of their third quarter needs through immediate commitments and specifications at old prices remains to be seen. So far, there is little indication of a rush to cover. Employed ingot capacity dipped a little more than 2 per cent this week, and finishing mills generally are working at a slightly slower pace.

Pig Iron—Many automotive foundries are well stocked. Demand for malleable iron in the Middle West markets is lighter, but the movement of iron from Lake Erie furnaces to Michigan automotive foundries is well maintained. Blast furnace interests are closely watching the effect of higher steel prices on demand, and to some extent will be guided by developments in the steel market.

Aluminum — The market for primary metals is unchanged, while that for secondary aluminum is a shade easier. Remelters generally appear to have lowered the prices at which they will take in scrap. Quotably, however, the various descriptions of remelted metal and alloys are unchanged.

Copper — Domestic business continues light as the result of heavy buying before the advance to 9½ cents. It is pointed out, however, that consumers are taking more and more tonnages from refineries against old contracts, and that this presages a return to more active, fresh buying after the summer. The "outside" market is quoted at 9.30 to 9⅝ cents, delivered Connecticut point.

Tin—The market is more animated. Straits tin was quoted at the beginning of the week at 45.70 cents.

Lead—Steady and unchanged.

Zinc—Quiet.

Calendar of Coming Events

SHOWS

Yugoslavia 16th International Spring Fair, Lubliana .....May 30-June 11
Olympia Motor Show, London, England, Oct. 15-24
National Motor Truck Show (N. J. Motor Truck Assn.), Newark, N. J., Nov. 3-7
National Automobile Show, Grand Central Palace, New York.....Nov. 11-18
International Aviation Show, Paris, France .....Nov. 13-29
Boston Automobile Show.....Nov. 14-21
Columbus Automobile Show ....Nov. 14-20
Chicago Automobile Show.....Nov. 14-21
Detroit Automobile Show.....Nov. 14-21
Washington, D. C., Automobile Show, Nov. 14-21
Cincinnati Automobile Show....Nov. 15-21
St. Louis Automobile Show.....Nov. 15-22
Baltimore Automobile Show....Nov. 21-28
Brooklyn Automobile Show.....Nov. 21-28*
Cleveland Automobile Show.....Nov. 21-28
Kansas City Automobile Show..Nov. 21-29*
Milwaukee Automobile Show....Nov. 22-29
Peoria Automobile Show...Nov. 30-Dec. 5*
Philadelphia Automobile Show, Nov. 30-Dec. 5*
Natl. Exposition of Power & Mechanical Engineering, Biennial Meeting, New York City .....Nov. 30-Dec. 5
Automotive Service Industries Joint Show, Chicago .....Dec. 9-14

* Tentative dates.

CONVENTIONS AND MEETINGS

S.A.E. Summer Meeting, White Sulphur Springs, W. Va.....May 31-June 6
Automotive Engine Rebuilders Assoc. Annual Convention, Cincinnati, June 1-4
National Association of Credit Men, 41st Annual Convention, Richmond, Va. June 8-12
National Oil and Gas Power Conference, American Society of Mechanical Engineers, University of Michigan, Ann Arbor .....June 24-27
American Society for Testing Materials, Annual Meeting, Atlantic City .....June 29-July 3
National Association Power Engineers, Annual Meeting, Chicago, Aug. 31-Sept. 4
American Transit Association, Convention, White Sulphur Springs, W. Va. .....Sept. 21-24
First Aircraft Production Meeting of the S. A. E., Los Angeles....Oct. 14-16
American Society for Metals, 18th Nat'l Congress, Cleveland, O. ....Oct. 19-23
American Gas Association, Annual Meeting, Atlantic City.....Oct. 26-31
American Petroleum Institute, Annual Meeting, Chicago .....Nov. 9-12
Natl. Industrial Traffic League, Annual Meeting, New York City.....Nov. 19-20

JUST AMONG OURSELVES

"Ought to be Law" Complex Pops Up

LAST week in Pittsburgh a group calling itself the Radio Technical Committee for Aviation met and considered the problem of radio interference originating with automobile ignition systems.

Apparently the committee deliberated in the dark, for it decided:

1. To take action to foster Federal legislation requiring that all automobiles manufactured after 1938 be adequately shielded at the factory for suppression of all interfering radiation of radio frequencies, and that existing automobiles be required to suppress such interference after Jan. 1, 1940.

2. That such legislation be extended to cover all types of engines using a spark for ignition purposes.

It's a tall order to ask for legislative solution to a problem for which the technical implications are not yet completely established.

Some time ago, the Society of Automotive Engineers and the Radio Manufacturers Association set up a joint Committee on Radio Interference which has been studying actively the effect of various forms of shielding on engine performance, and the effectiveness of the various agents to do the job for which they are intended.

This committee has established, among other things, that two identical cars treated identically for suppression of interfering radiation will give widely varying results in effectiveness of the shielding. This is just one of the problems which has arisen from an honest attempt to study the complaints. To ask for mandatory legislation on such a subject at this stage of the game is about as illogical as to seek legislation requiring that all physicians shall find and apply to all their patients a complete cure for the common cold by the year 1940.

Larger Profits Not All Blessing

ONE of our contemporaries notes that the labor situation in some companies is such that when the company publishes a good earnings statement on one day, a deputation of workers is likely to visit the front office the next day asking for a piece of the profits.

In one instance we know of, the deputation of workers was received by the president of the company, who carefully explained the nature of a balance sheet, pointing out that "profit" is a rather elastic term, and that until materials in inventory were converted into salable goods a large part of the company's profit was simply a matter of bookkeeping.

This seemed to satisfy (or mystify) the members of the deputation for a little while until one of them came through with this brilliant piece of reasoning: "Well, Mr. President, if the profit is a matter of bookkeeping, why don't you double the profit shown, and give us half of it in increased wages?" That, so far as we know, is a true story.

Increased profits by automobile manufacturers are being regarded sourly from another angle.

Dealers Asking "What's Our Share?"

A RECENT letter from the secretary of one of the automobile trade associations notes that labor (at the South Bend convention) complained that it was not getting its share of the reported 145 per cent increase in automobile manufacturers' profits for the year 1935. Labor's increase was 32 per cent in the same period, according to the South Bend report.

The trade association secretary poses a sharp question in view of these figures: "What should 'the dealer' expect between said 145 per cent and 32 per cent for the part he plays in the picture?"

We're not going to try to answer that question at this writing. In fact, it would take a text book on economics to even try to answer it, for wrapped up in the apparently simple question are the whole province of economics—and of logic.

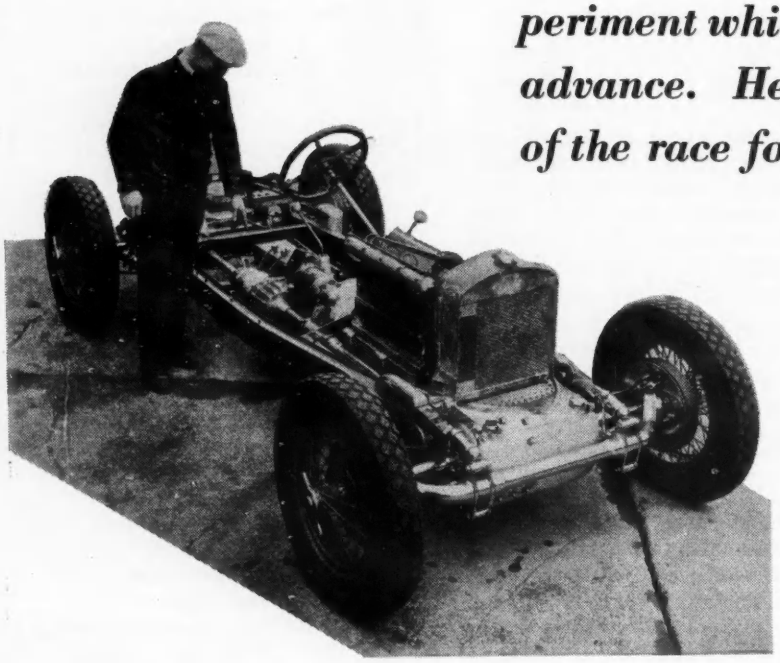
But the question is being asked, in similar terms, in Detroit, where dealer mortality has been fairly heavy, and in many other sections of the country where dealers have been having tough sledding through the Winter, and where the Spring hasn't brought its quota of buttercups and daisies.

More Than Just A New Factory

WITH the opening of a new plant at Los Angeles this week, the General Motors Corp. gave physical form to the thrice-expressed statements of Alfred P. Sloan, Jr., that the way to prosperity is through the creation of new industries and new jobs.—H. H.

Burning Bricks

at Indianapolis on Memorial Day is the final result of engineering experiment which goes on for months in advance. Here is the important story of the race for automotive engineers.



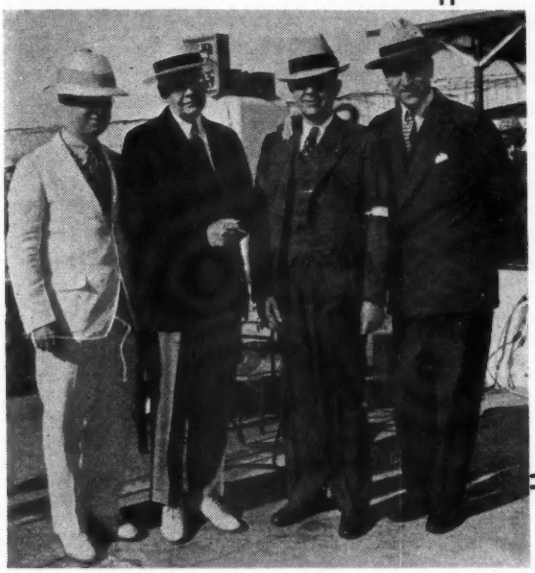
This is one of the F. W. D. entries in the great classic ready for the final tune up

TODAY, May 22, writing this in the pagoda at the Indianapolis Motor Speedway, with the roar of the exhausts from cars which are out running gasoline tests, one gets the spirit of anxiety which is confronting every driver this year. The new rules this year, for the first time in the history of the track, abandoned a piston displacement limit and placed all the limitations on the fuel allowed. They also reduced the minimum weight to 1800 pounds from 1950, which will only require the removal of some pig lead carried last year for ballast. For 203 laps or 507.5 miles which every car is required to make, the 1936 fuel limit of 37.5 gallons is equivalent to 13.53 miles per gallon. Last year 42.5 gallons were allowed equivalent to 11.94 miles per gallon. Reducing the fuel allowance 11.7 per cent is the reason for the headaches in the garages but is in keeping with the trend in commercial automotive activities where everyone is striving to get more miles per gallon without sacrificing performance.

Trying to pick the probable winner at this time is as difficult as trying to say who will be the next Republican nominee for president. If the race is too fast on the day of the race some of the contestants are liable to run out of fuel before the finish. This will add a new element to the uncertainty and suspense which always makes a race interesting. One of the drivers told the writer that the way he was going to figure out his speed was after the first 81 laps. If he ran more than that before he had to come in for gas he knew that he was safe and could drive faster. If he came in before 81 laps then he would have to cut down his speed and

The Gilmore Special driven by Rex Mays has made the fastest time yet, though not so well streamlined as the one driven by Shaw

By Chester S. Ricker



who appears at the left of the picture, in company with the "big three" of the Indianapolis Speedway. Next to Mr. Ricker is T. E. ("Pop") Myers, vice-president and general manager of the Indianapolis Motor Speedway Corp.; then Charles C. Merz, president of the Merz Engineering Co., Indianapolis, and chief steward of the Memorial Day Race; and at the right Col. E. V. ("Eddie") Rickenbacker, president of the Speedway and chairman of the Contest Board of the American Automobile Association.

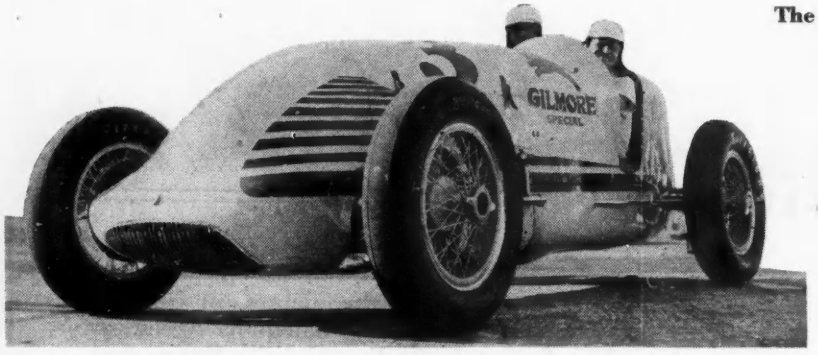
Mr. Ricker, the author of this article, has been director of timing and scoring at the Indianapolis Speedway since 1914. From 1914 to 1916 he was chairman of the technical committee at the track, and during the first three years of the 500-mile race was a member of the technical committee responsible for it. As a consulting automotive engineer he is associated with McCann-Erickson, Inc., as technical counsel on automotive and petroleum advertising accounts.

His thorough grounding in the technical features, history and performance of the Indianapolis Race have enabled Mr. Ricker to write an advance story which contains matter of interest to every automotive engineer.

be sure to get 162 before a second fuel stop or he might not finish the race. This is likely to upset the latter part of the race very markedly. In last years' race the winner averaged 107.1 miles per hour net running time and 12.6 miles per gallon. He had a 267 cubic inch four cylinder Miller engine. This year in the first qualification trials, Wilbur Shaw, driving a 255 cubic inch engine of the same dual camshaft type, an Offenhauser four cylinder, not only made 117.5 miles per hour for 25 miles but averaged 15.5 miles per gallon. This is two miles per gallon more than is needed to finish the race on the fuel allowance, in fact on that basis he would have 4.7 gallons left at the finish. This only means that here is one driver that has all the speed and fuel he needs to win the race if he does not have mechanical trouble or an accident.

Needless to say the quest for greater economy without loss of average speed has brought no end of interesting experiments both from racing drivers and from the best brains in the automotive industry who see the opportunity to profit by the experiments made on these racing cars. Gilmore Oil Co., Ethyl Gas Corp., Standard Oil and Shell all have men on the job working on what the boys here call "Mystery" fuels. Never since the early days of auto racing have I ever seen such secretiveness. No one wants to divulge what mixture they are trying out. Rear axle gear ratios are also secret as well as carburetor settings. L. Vollmar, engineer for United American Bosch has practically all of the cars equipped with his magnetos. Since the cars do not carry batteries the magneto is essential. Starting motors are also carried but without battery. A battery terminal plug of some kind is conveniently placed on the outside of the chassis so outside battery cables can quickly be connected when it it necessary to start the engine at the pits. Only Firestone tires are used, a tribute both to Firestone engineers and Waldo Stein who represents Mr. Firestone in these racing activities. As a former mechanic for Barney Oldfield, he grew up in the racing game and is an ideal liaison engineer for his organization. Carburetor engineers are also right here on the job representing Zenith, Stromberg and Winfield. Earl Twining and O. C. Rhode, chief engineer of the Champion Spark Plug Co. are on the job and ready for the worst conditions that they may have to meet with a new type of spark plug. Johnson of Packard Cable Co. has their equipment on all cars except three. This brief list indicates the interest that prominent suppliers of standard parts are taking in the problems of the race car of today but probably the production car of tomorrow. Perfect Circle Ring Co. have a large proportion of the cars using their rings and their engineers are working with the drivers. One of the newcomers is the Thompson Products Co. who are experimenting with special cylinder sleeves. Jadson from the Pacific Coast has most of the valves used in the Miller and Offenhauser engines.

Although there were fifty entries for the race only 44 have put in an appear-



The streamlining of the Gilmore driven by Shaw is creating considerable interest

ance to date and 16 have already qualified. The remaining 28 will have a chance to qualify on the 23rd, 24th, 25th and 26th.

Of the 44 entries, 34 or 77 per cent are four cylinder engined with four valves per cylinder and double overhead camshafts. This is the so-called Miller design although they have been built by four different engine makers. Twenty-two of them are original Millers, 10 made by Fred Offenhauser of Los Angeles, who was Miller's shop superintendent, one by Thompson Products and one by Cragar. The eight cylinder Millers have but two valves per cylinder. There are nine eights entered, two sixes, both modified Dodges, and one sixteen, a sleeved Marmon job. Only six have "Ell" head engines and only one has an overhead valve engine with push rods and rocker arms. The latter is a Buick eight adapted to racing. Of the eights, the Bugatti is quite the most interesting because it is a European design, has but three valves per cylinder and a supercharger, the only one in the race. It is also the smallest engine in the race so if it qualifies it will be most interesting to watch.

The piston displacements run as follows:

	Cu. in.
One Bugatti 8	139
One Miller 8	151
One Miller 8	181
One Miller 8	178
One Cooper 16	191
One Miller 4	203
One Cragar 4	214
Two Dodge 6	217
Five Miller 4	220
One Offenh. 4	221
One Miller 4	226
Two Miller 8	237
Two Stude. 8	250
One Miller 8	250
One Thompson 4	251
Four Miller 4	247
Five Miller 4	255
Nine Offenh. 4	255
One Miller 4	260
One Miller 4	269
One Buick 8	294
One Stude. 8	337

As They Are Ready to Go

Car No.	Driver	Car Name	Entrant	Engine	No. Cyl.	Bore	Stroke	Piston Displ.	Type	Carburetor No.	Carburetor Make
33	Rex Mays	Gilmore Special	Paul Weirick	Miller	4	4.000	4.750	238.0	O.H.C.	2	W
21	"Babe" Stapp	Pirrung Special	Gil Pirrung	O	4	4.073	4.250	221	O.H.C.	2	W 1¾
18	Chet Miller	Boyle Valve Special	H. C. Henning	M	8	2.656	3.500	151	O.H.C.	4	W
10	Doc McKinzie	Gilmore Speedway Special	Kelly Petillo	Miller	4	4.125	4.625	247	O.H.C.	2	W
38	G. Conner	Marks Miller Special	Joe Marks	M	4	4.260	4.500	255	O.H.C.	2	M 1¾
44	H. Ardinger	Bowes Seal Fast Special	Bowes Seal Fast	M	4	4.062	4.250	220	O.H.C.	2	W
42	C. Bergere	Bowes Seal Fast Special	Bowes Seal Fast	M	4	4.062	4.250	220	O.H.C.	2	W
46	Fred Frame	Burd Piston Ring Special	L. Stapp	M	4	4.062	4.125	220	O.H.C.	2	W
3	Wilbur Shaw	Gilmore Special	Wilbur Shaw	O	4	4.250	4.500	255	O.H.C.	2	W
22	Ted Horn	Hartz Special	Harry Hartz	M	8	2.875	3.500	181	O.H.C.	4	W
7	Shorty Cantlon	Hamilton Harris Special	Bill White	M	4	4.125	4.625	247	O.H.C.	2	M 1⅝
35	Fred Winnai	Midwest Red Lion Special	Midwest Racing Team	O	4	4.250	4.500	255	O.H.C.	2	W
2	Bill Cummins	Boyle Valve Special	H. C. Henning	O	4	4.250	4.500	255	O.H.C.	2	W
17	Geo. Barringer	Shafer Special	Phil Shafer	O	4	4.250	4.500	255	O.H.C.	2	W
56		DeBaets Special*	Michael De Baets	F	4	4.000	5.000	251	O.H.C.	2	L
4	Floyd Roberts	Burd Piston Ring Special	Burd Piston Ring Co.	O	4	4.250	4.500	255	O.H.C.	2	W
5	Billy Winn	Harry Miller	James M. Winn	M	4	4.290	4.500	260	O.H.C.	2	W
6	Chet Gardner		Chet Gardner	O	4	4.250	4.500	255	O.H.C.	2	W
43	Jimmy Snyder	Bellanger Miller Special	Merle Bellanger	M	8	3.260	3.750	250	O.H.C.	4	W
8	Louis Meyer	Ring Free Special	Louis Meyer	M	4	4.250	4.500	255	O.H.C.	2	W
28	Harry McQuinn	Sampson Special	Alden Sampson	M	4	4.062	4.500	237	O.H.C.	2	W d.d.
9	Ralph Hepburn		Ralph Hepburn	O	4	4.250	4.500	255	O.H.C.	2	W
12	Al Miller	Boyle Valve Special	H. C. Henning	M	4	4.290	4.500	260	O.H.C.	2	W up-d.
14	Frank Brisko	Elgin Piston Pin Special	Elgin Piston Pin Co.	M	4	4.250	4.500	255	O.H.C.	2	L
15	Deacon Litz	Litz Special	Deacon Litz	M	4	4.112	4.250	225.7	O.H.C.	2	M
25	Joe Thorne	D. & P. Special	Clifford Thorne	D	6	3.250	4.375	217.0	L.H.	3	W
24	Overton Snell	Snell Bros.	Snell Bros.	M	4	4.062	4.250	220	O.H.C.	2	W
29	Henry Banks	De Palma-Miller Special	Louis Kimmel	M	8	2.750	3.750	178	O.H.C.	2	W
34	Roy Painter	American Twist Drill Special	Ted Nowiak, Carl Magnee	S	8	3.113	4.125	250	L.H.	2	W
36	Mauri Rose	F.W.D. Special	F.W.D. Auto Co.	M	4	4.250	4.500	255	O.H.C.	2	W 1¾
41	Ray Pixley	Fink Auto Special	C. W. Feekner	M	4	3.687	4.750	203	O.H.C.	2	W
47	Johnny Seymour	Sullivan & OBrien Special	Shorty Cantlon	M	4	4.062	4.750	246	O.H.C.	2	W 1¾
....	R. Snowberger	D. & P. Special	Clifford Thorne	D	6	3.250	4.375	217.0	L.H.	3	W
26	Phil Shafer	Shafer Special	Phil Shafer	B	8	3.181	4.625	294	O.H.R.	4	W
52	Frank McGuirk		C. W. Worley	Ford Bloc	4	4.000	4.250	214	O.H.C.	2	W
49	Luther Johnson	Bugatti Special	Overton Phillips	Bugatti	8	2.735	3.937	139.0	O.H.C.	1	W
19	Emil Andres	Carew Special	J. S. Carew	Cr.	4	4.000	4.250	214	O.H.C.	2	W
53	Zeke Meyer		R. Snowberger	S	8	3.0625	4.250	250	L.H.	2	S
27	Dave Evans	Burd Piston Ring Special		O	4	4.250	4.500	255	O.H.C.	....	.....
32	Lou Moore	Burd Piston Ring Special		O	4	4.250	4.500	255	O.H.C.	....	.....
54	Doc Williams	Superior Trailer Special	Race Car Corp.	M	4	4.0625	4.750	246	O.H.C.	4	W
55	Dusty Farnow	Superior Trailer Special	Race Car Corp.	C	16	2.250	3.000	191	O.H.C.	4	W
58	Harry Hunt	Hunt Special	Harry Hunt	D	8	2.9475	5.000	248	O.H.C.	....	.....
51	George Bailey	Martz Special	Robert Zauer	Hudson	8	3.010	4.500	257	.....	....	.....

ABBREVIATIONS:

Engine
O—Offenhauser
M—Miller
S—Studebaker
F—Ford
D—Dodge
Cr.—Crager

Type
O.H.C.—Overhead cam
L.H.—"L" Head
O.H.R.—Overhead rocker arms

Carburetor
W—Winfield
M—Miller
Z—Zenith
L—Linkart

Ignition
B—Bosch Mag.

Spark Plugs—Make
C—Champion

Drive
T-T—Torque Tube
H—Hotchkiss

* May be renamed

Reducing the wind resistance by keeping the Seal Fast Special very low saves fuel

Although a great number of Miller engines are used they vary widely in size of their cylinders. For example, as to bore, they vary from 3.687″ to 4.25″. One each have 3.687″ and 4.000″ bore, seven have 4.25″, six 4.062″ and four 4.125″. Their strokes vary from 4.125″ to 4.75″ of which seven have 4.50″, four 4.25″, four 4.75″, two 4.125″ and two 4.625″. Of the four Miller eights, two have 3.5″ stroke and two 3.75″. Their bores are 2.75, 2.625, 2.875 and 3.26 inches. Of the ten Offenhauser four one has 4.973″ bore and 4.25″ stroke, all the others which are new this year, 4.25″ and 4.500″ bore and stroke. The details of the other engines can be obtained from the table. The Studebaker being the biggest engine in the field.

If any of the "Ell" head engines are able to give a good performance it will be remarkable because of natural limitations to the design when unusually high compression ratios are used. The prevailing compression ratios run from 10 to 1 up to 14 to 1. Some of the smaller bore engines last year were able to run up to as high as 18 to 1 but they were so rough that they were lowered to 14 to 1 for the race. An overhead engine of this type is virtually a semi-diesel and has so little clearance that the hollow head tulip type valve cannot be used. In fact the clearance between the cylinder and piston heads measures only 0.027″. Heavy fuels are being used to give the maximum mileage per gallon, in fact they are little more than glorified fuel oil in some cases apparently. One of the cars has three Zenith four jet carburetors all mounted on one manifold. They are down draft type and like all racing carburetors have no accelerator pumps. They dump into a common horizontal manifold. On top of the air opening is a standard marine fire arrestor, which consists of

Equipment as of May 26, 1936, but subject to change before the race

Ignition Make	Ignition Wire Make	Spark Plugs Make-Size	Drive React.	Drive F-R	Tires		Brakes Type M-H	Shock Absorbers		Springs		Starter C-E
					Front	Rear		Front	Rear	Front	Rear	
B	Pack	C	T-T	R	.....	.....	4-H	2 Ha; 2 Ho	2 Ha; 2 Ho	½-E	Trans	B-E
B	Belden	Bowes	F	F	18-7.00	18-7.00	Fr.M-R.H.	G—F	G—F	Cant	½-E	Bos.-E
B	Pack	C	Cant.	F	20-6.00	20-6.00	Miller M.	H	H	¼-C	¼-C	C
B	Pack	C	T-T	R	.....	.....	4-M	2-G	G-Ha	½-E	½-E	B-E
B	Pack	C	T-T	R	18-6.00	18-7.00	4-M	Ha—F	Ha—F	½-E	Trans	B-E
B	Pack	Bowes	H	R	18-6.00	18-7.00	4-M	L	L	½-E	½-E	B-E
B	Pack	Bowes	H	R	18-6.00	18-7.00	4-M	L	L	½-E	½-E	B-E
B	Pack	C	T-T	R	18-6.00	18-7.00	4-M	Ha—W	Ha	½-E	Trans	Delco
B	Pack	C	T-T	R	18-6.00	18-7.00	4-H	G	G	½-E	Trans	B-E
B	Pack	C	F-W	F	20-6.50	20-6.50	M	Ha	Ha	C	½-E	C
B	Pack	C	T-T	R	18-6.00	18-7.00	4-M	L	L	½-E	½-E	B-E
B	Pack	C	T-T	R	20-6.00	20-6.00	4-M	G	Ha	½-E	½-E	Delco
B	Pack	C	Cant	F	20-6.00	20-6.00	4-M	Ha	Ha	¼-Cant	¼-Cant	Delco
B	Pack	C	T-T	R	18-6.00	18-7.00	4-H	G—F	G—F	½-E	½-E	B-E
B	Belden	Bowes	T-T	R	18-6.00	18-7.00	4-M	G	G	½-E	½-E	Delco
B	Pack	C	T-T	R	18-6.00	18-7.00	Fr.M-R.H.	F—Ha	Ha	½-E	½-E	B-E
B	Pack	C	T-T	R	18-6.00	18.7.00	M-H	Ha—G	Ha—G	½-E	½-E	B-E
B	Pack	C	T-T	R	18-6.00	18-7.00	4-H	Ha—G	G	½-E	½-E	B-E
B	Pack	C	T-T	R	18-6.00	18-7.00	4-M	Ha—F	Ha—F	½-E	½-E	B-E
B	Pack	C	T-T	R	18-6.00	18-7.00	4-M	Ha	Ha	½-E	½-E	B-E
B	Pack	C	T-T	R	20-6.00	20-6.00	4-H	Ha	Ha	½-E	½-E	B-E
B	Pack	..	T-T	R	.....	.....	4-M	G—F	G—F	¼-E (dual)	¼-E (dual)	B-E
B	Pack	C	T-T	R	18-6.00	18-7.00	4-M	G—Ha	G—Ha	½-E	½-E	B-E
B	Pack	C	T-T	R	18-6.00	18-6.00	4-M	Ha	Ha	½-E	Trans	B-E
B	Pack	C	T-T	R	18-6.00	18-7.00	4-M	G—Ha	G—Ha	½-E	½-E	B-E
Delco Batt.	Pack	C	T-T	R	18-6.00	18-6.50	2-M; 4-H	A	A	½-E	½-E	Delco
B	Pack	C	T-T (Hotch)	R	20-6.00	20-6.50	4-M	G	G	½-E	½-E	Spec. E
B	Pack	C	T-T	R	18-6.00	18-7.00	4-H	Ha	Ha	½-E	½-E	C
B	Pack	C	T-T	R	18-6.00	18-7.00	4-H	Ho	Ho	½-E	½-E	Delco
B	Pack	C	H	F.W.D.	18-7.00	18-7.00	4-M	Ha—F	Ha—F	¼-E	¼-E	B-E
B	Pack	C	T-T	R	18-6.00	18-7.00	4-M	Ha—F	Ha—F	¼-E	¼-E	B-E
B	Pack	C	T-T	R	18-6.00	18-7.00	4-M	L	L	½-E	½-E	Delco
Delco Batt.	Pack	C	T-T	R	18-6.00	18-6.50	2-M; 4-H	A	A	½-E	½-E	Delco
Delco Batt.	Pack	C	T-T	R	.....	.....	4-M	D	Ha	½-E	½-E	Delco
B	Pack	C	T-T	R	18-6.00	18-7.00	4-M	G	Ho	½-E	Trans	Ford
S.E.V.	....	C	T-T	R	18-6.00	18-7.00	4-M	Ha (French)	F-Ha (Buggati)	½-E	¼-E	B-E
B	Pack	C	T-T	R	18-6.00	18-7.00	4-H	Ho	Ho	½-E	Trans	B-E
B	Pack	C	H	F	20-6.00	20-6.00	4-M	G	Delco	¼-E	½-E	Delco
..	....	..	....	..	.....	.....	....	....	....	....	....	....
..	....	..	....	..	.....	.....	....	....	....	....	....	....
B	Pack	C	....	..	.....	.....	....	....	....	....	....	....
B	Pack	C	....	..	.....	.....	....	....	....	....	....	....
..	....	..	....	..	.....	.....	....	....	....	....	....	....
..	....	..	....	..	.....	.....	....	....	....	....	....	....

Drive
F—Front
R—Rear

Brakes—Type
M—Mechanical
H—Hydraulic

Shock Absorbers
G—Gabriel
Ha—Hartford
Ho—Houde
F—Fagro
D—Delco
L—Lovejoy
A—Andre

Starter
C—Crank
B-E—Bosch-Electric

TABLE I

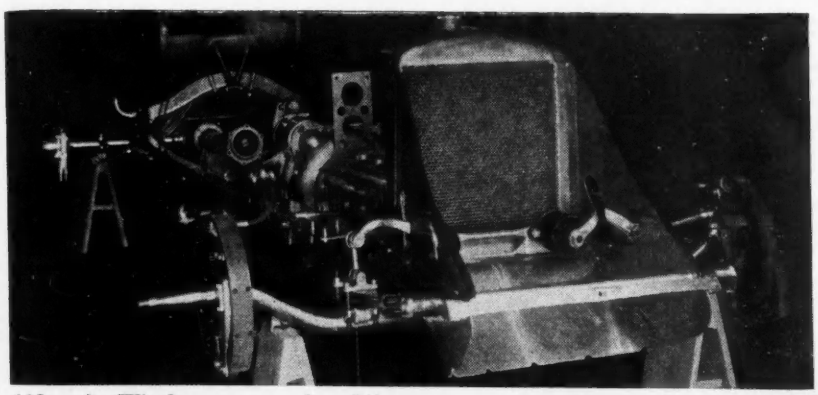
Cars Qualified—Arranged According to Miles Per Gallon Used in Trial (30 Miles)

Car No.	Make Special	Driver	Miles Per Gallon	Speed M.P.H.	Engine Make	Cyls.	Cu. In. Displ.
3	Gilmore,	Wilbur Shaw	15.5	117.503	Offenhauser	4	255.0
6	Gardner,	Chet Gardner	13.9	116.000	Offenhauser	4	255.0
33	Gilmore,	Rex Mays	13.3	119.644	Miller	4	238.0
5	Harry Miller,	Billy Winn	13.3	114.648	Miller	4	260.0
52	Abels Auto,	Frank McGuirk	13.3	113.102	Ford "A"	4	214.0
7	Hamilton Harris,	"Shorty" Cantlon	13.0	116.912	Miller	4	247.0
38	Marks Miller,	Geo. Connor	13.0	116.269	Miller	4	255.0
12	Boyle Prod.,	Al. Miller	13.0	116.138	Miller	4	260.0
2	Boyle Prod.,	"Bill" Cummings	13.0	115.939	Offenhauser	4	255.0
47	Sullivan-O'Brien,	"Johnny" Seymour	13.0	113.169	Miller	4	246.0
41	Fink Auto,	Ray Pixley	12.7	116.703	Miller	4	203.0
15	Deacon Litz,	"Deacon" Litz	12.6	115.997	Miller	4	225.7
42	Bowes SealFast,	"Cliff" Bergere	12.6	113.377	Miller	4	220.0
27	Wheeler,	Louis Tomei	12.6	111.078	Miller	4	220.0
21	Pirrung,	"Babe" Stapp	12.4	118.945	Offenhauser	4	221.0
44	Bowes SealFast,	"Herb" Ardinger	12.4	115.082	Miller	4	220.0
17	Shafer,	Geo. Barringer	12.4	112.700	Offenhauser	4	255.0
18	Boyle Valve,	Chet. Miller	12.3	117.675	Miller	8	151.0
10	Gilmore Speedway,	"Doc" MacKenzie	12.3	116.961	Miller	4	247.0
24	Snell,	Overton Snell	12.3	109.561	Miller	4	220.0
22	Hartz,	Ted Horn	12.0	116.564	Miller	8	181.0
35	Mid-West Red Lion,	Fred Winnai	12.0	116.221	Offenhauser	4	255.0
14	Elgin Piston Pin,	Frank Briscoe	12.0	114.213	Miller	4	255.0
28	Sampson Radio,	Harry McQuinn	12.0	114.118	Miller	4	237.0
54	Superior Trailer,	"Doc" Williams	12.0	112.837	Miller	4	246.0
9	Art Rose,	Ralph Hepburn	12.0	112.673	Offenhauser	4	255.0
4	Burd Piston Ring,	Floyd Roberts	12.0	112.403	Offenhauser	4	255.0
43	Belanger Miller,	"Johnny" Snyder	12.0	111.291	Miller	4	250.0
34	Am. Twist Drill,	Roy Painter	12.0	109.867	Studebaker	8	250.0

Qualifiers at Indianapolis Motor Speedway

(As of May 25—2 more days of qualification may change order of starters)

Car No.	Driver	Sped M.P.H. for 25 miles	Car No.	Driver	Sped M.P.H. for 25 miles	Car No.	Driver	Sped M.P.H. for 25 miles
33	Rex Mayes	119.644	38	Geo. Connor	116.269	14	Frank Briscoe	114.213
21	"Babe" Stapp	118.945	35	Freddie Winnai	116.221	28	Harry McQuinn	114.118
18	Chet. Miller	117.675	12	Al Miller	116.138	42	Cliff Bergere	113.377
3	Wilbur Shaw	117.503	6	Chet. Gardner	116.000	47	"Johnny" Seymour	113.169
10	"Doc" Mackenzie	116.961	15	"Deacon" Litz	115.997	52	Frank McGurk	113.102
7	"Shorty" Cantlon	116.912	2	"Bill" Cummings	115.939	54	"Doc" Williams	112.837
41	Ray Pixley	116.703	44	Herb. Ardinger	115.082	17	Geo. Barringer	112.700
22	Ted Horn	116.564	5	"Billy" Winn	114.648	9	Ralph Hepburn	112.673
						4	Floyd Roberts	112.403

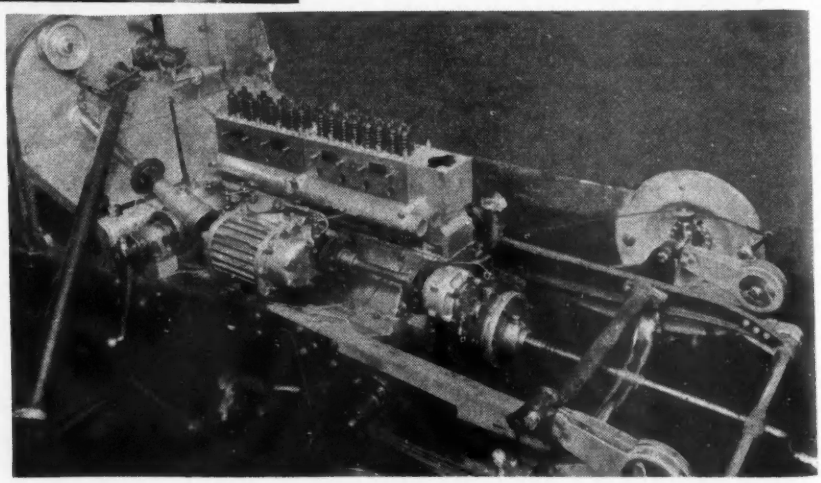


(Above) Windscoop on the Gilmore Special driven by Shaw

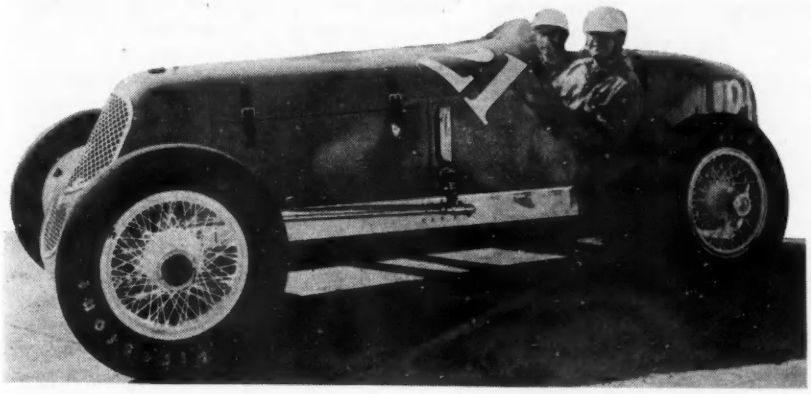
a series of X parallel ½ in. strips of shim stock about 1/32 in. apart and set vertically. To start this engine it is necessary to prime the carburetor by squirting a priming charge on this metal grid. Because of the proximity of these shims the fuel is held by capillary attraction until the engine is turned over and it is sucked in with the air stream. This is typical of the carburetion problems which these "Mystery" fuels have developed.

The mixtures have become so lean that much trouble is being experienced by some of the cars in keeping their engines cool internally. Valves, spark plugs and cylinders have suffered. There seems to be an epidemic of cracked cylinder blocks due perhaps to incipient or actual detonation which takes place while running with these lean mixtures but inaudible to the drivers under the high speed conditions of operations.

To meet these difficult conditions of operation the Champion Spark Plug Company have a new plug, the design of their chief engineer, Mr. Rhode. They call it the MR-5. It consists of a copper central electrode that is of much larger section than heretofore used. The electrode is embedded in Silamanite cement and the cement is protected from the head by mica insulation at the combustion chamber end. The method of heat transference is from the electrode to the cement to the plug body and to the water jacket. A cold rolled steel electrode conductor is screwed into the copper electrode to reduce the heat flow up the conductor to the wiring. This has been found very important not only in racing but in aviation engine ignition. The unique feature of this design is in the high heat conductivity of the cement without loss of the insulating properties of the material. This is the type of plug which was recently used in the record breaking Austin in England which developed 95 horsepower from a 45 cubic inch displacement engine running 12,000 r.p.m. and having a 15 pound supercharger pressure. It is the kind of plug which will go through a 100 hour aviation engine acceptance test where the previous plugs would not stand up more than 33 hours. Naturally



(Below) The Bugatti front end and engine partially disassembled showing the supercharger and triple valves



Babe Stapp in his Pirrung. Note that the rear springs are covered

Thompson nitrided sleeves for Gulotta's car

with this kind of plug available the boys have been able to get ignition even with the super fuel and lean mixtures that they have been using.

While on the subject of the electric equipment of the cars do not overlook the magneto and starting motors. They are practically all Bosch equipped. Many of these new high compression engines have six volt starters but use three and even four batteries in series to start them. That is 18 to 24 volts. All of this, of course, is not available at the starter because quite long leads are necessary to reach from the batteries in the pit to the starter on the car.

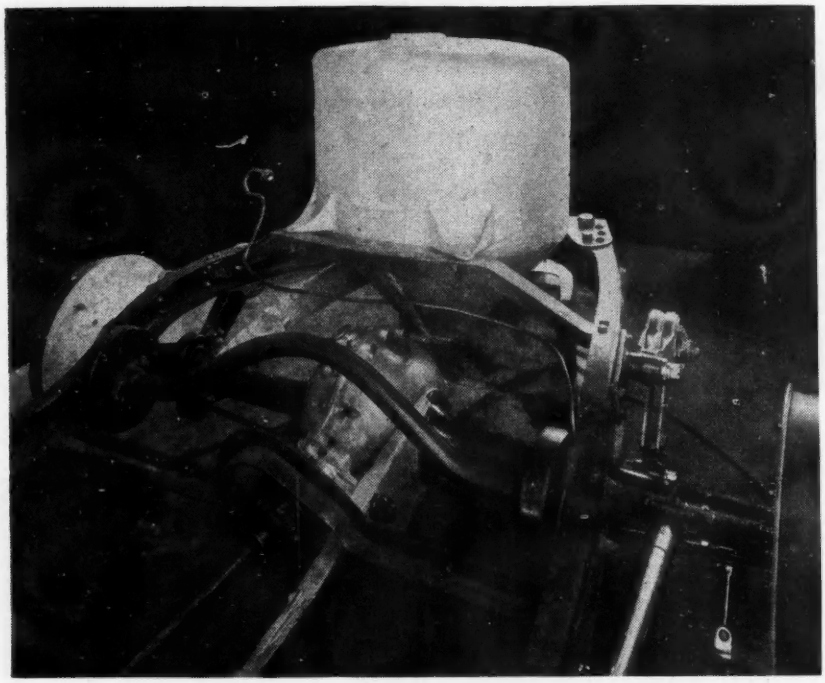
The ignition by Bosch this year is particularly interesting because a new type of inductor magneto is used. It is called the J-O model and was specially imported from Germany for this race as they are not made in this country at the present time. This magneto is much lighter in weight than the one which it replaces. It is of the inductor type with a four pole rotator with a distributor on the rotor shaft. The magneto is attached to the drive shaft with a helical splined shaft so that it may be advanced or retarded without disturbing the maximum spark strength. It is claimed that a 7 mm spark can be obtained at starting speed and 14 mm at 400 r.p.m. The condenser is incorporated in the windings instead of being separate and the inductor rotor is a solid steel casting from Mischa steel. They claim that this has twice the magnetic properties of the best Cobalt steel now used. This was the magneto that has been used on the record breaking Mercedes and Auto-union cars during the past year in Europe. One of the problems in applying this magneto to the 500 mile race cars is the fact that it is only available in eight cylinder engine design. To run this without utilizing the intermediate sparks would cause a bad electrical and torque reaction. The solution was the use of a screened spark gap attached to the front end of the engine adjacent to the magneto and each of the four unused wires brought to this gap. They are insulated from one another but jump the gap to ground inside of the screen.

In the valve field, Thompson Products have their valves on the engine which they built. Boyle valves are found on all Boyle Products cars and the Miller and Offenhauser engines use Jadson which are made on the coast. The Jadson enginer said that they were trying out some of the inserted seats which they use in trucks and tractor engines.

TABLE II
Analysis of 1934 Race
45 Gallons Fuel Allowed

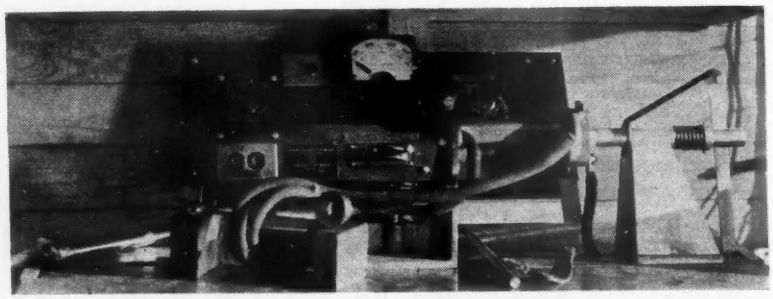
Finish Position	Car Name	Driver	Average Speed M. P. H.	Net Speed Average M. P. H.	Miles per gallon*	Stops No. Time	Engine Make and Cylinders	Displ. Cu. In.
						min. sec.		
1	Boyle Products	Bill Cummings	104.863	106.1	14.3	(2) 3-57	Miller 4	221
2	Duray	Mauri Rose	104.697	105.3	14.0	(2) 2-20	Miller 4	220
3	Foreman Axle	Lou Moore	102.625	103.5	14.2	(2) 2-50	Miller 4	255
4	Stokely	Deacon Litz	100.749	103.7	13.8	(4) 9-00	Miller 4	220
5	Duesenberg	Joe Russo	99.893	101.2	12.9	(3) 4-45	Duesenberg 8	276
6	Shafer	Al Miller	98.274	101.3	13.4	(3) 9-48	Buick 8	284
7	Floating Power	Cliff Bergere	97.818	100.7	14.3	(5) 9-15	Miller 4	205
8	Russell 8	R. Snowberger	97.297	98.6	12.7	(2) 3-58	Studebaker 8	337
9	F. W. D.	Frank Briscoe	96.787	99.5	15.0	(4) 7-50	Miller 4	255
10	Lucenti	Herb Ardinger	95.936	100.1	11.8	(6) 13-17	Graham 8	281.6
11	Red Lion	K. Petillo	93.432	103.1	13.6	(7) 30-37	Miller 4	255
12	Cummins	Dave Evans	88.566	....	14.1	.....	Cummins 4	364

Note that only 3 cars in 1934 with practically the same engines and chasses did not exceed 13.6 miles per gallon required under the 37.5 gallon limit this year.
* Basis 203 laps 507.5 miles.



Bugatti rear springs and stabilator between shock absorbers

on their wearing surface from 900 to 1000 and are so hard that they can hardly be ground after hardening. Why they are being used is perhaps of particular interest to all engineers. Ordinarily a sleeve has been used on racing cars to correct a cracked or scored cylinder or to reduce the displacement. It is not the case with these engines. The hardened cylinder is not only a preventive of cracking under the high temperature conditions in these engines but the piston and ring friction has been materially reduced, it is claimed by the users. The walls are so true that the rings do not jump from hill to hill at high speed as they do in some of the



Magnaflux magnetizing a steering arm

They find that they can insert a seat, even in racing motor cycle engines with only one to one and a half thousandths press fit. They use a tough alloy steel seat but the valve does not touch this seat. Instead they use a softer alloy which is electrically welded onto the face of the seat. This does not pound out because it is backed by a tough insert ring but the valve seats against it much better and stays put longer than when it bears against a hard seat metal. Here is a new theory in regard to valve seat inserts. A laminated seat with a soft wearing face and a tough back. Also they think that it is unnecessary to have much more than a light press fit in putting in inserts instead of putting them by cold shrinkage in dry ice. It is possible of course that the dry ice method only takes the place of the arbor press and the resultant fit is the same.

Next come the pistons which are uniformly of aluminum. Some new developments, however, are in the air this year and as yet are not so well worked out that anything more than observations can be made. Three engines have inserted cylinder sleeves. Two of them, have dry sleeves and one a wet sleeve. It is hoped that the Thompson engine which has the latter will be put in another chassis in time to qualify and run in the race. It was in the Pirrung front wheel drive job that hit the wall last week when the steering gear broke and was eliminated. This engine has cast iron cylinder block and wet steel sleeves fastened to the block top, I understand, and a round rubber gasket at the bottom of the water jacket, sets in a "Vee" groove in the block and prevents water leakage at this point without restraining the longitudinal expansion of the sleeve. These sleeves are about ⅛ to 3/16 in. thick in the wall and are not ordinary iron but nitrided steel. The dry sleeves are pressed in with about a thousandth press fit. They Brinnel older cast iron cylinders. On the dynamometer there is a very marked saving in piston and ring friction with these hardened liners and out here where every bit of friction must be reduced to save the drops of gasoline it has appealed to the drivers who can afford it

TABLE III
Analysis of 1935 Race

42.5 Gallons Fuel Allowed

Finish Position	Car Name	Driver	Average Speed M. P. H.	Net Speed Average M. P. H.	Miles per gallon*	Stops No. Time	Engine Make and Cylinders	Displ. Cu. In.
						min. sec.		
1	Gilmore	K. Petillo	106.240	107.1	12.63	(2) 2-57	Miller 4	262.4
2	Pirrung	Wilbur Shaw	105.990	107.0	12.84	(2) 3-20	Miller 4	220
3	Boyle Products	Bill Cummings	104.758	106.5	12.32	(2) 4-45	Miller 4	221
4	Abels-Fink	Floyd Roberts	103.228	105.6	13.52	(3) 6-49	Miller 4	255
5	Veedol	Ralph Hepburn	103.177	104.0	12.52	(2) 2-50	Miller 8	258.4
6	Sullivan O'Brien	Shorty Cantlon	101.140	103.1	11.93	(3) 6-04	Miller 4	255
7	Sampson	Chet Gardner	101.129	102.1	12.44	(2) 3-21	Miller 4	220
8	Litz	Deacon Litz	100.907	103.2	12.52	(3) 7-51	Miller 4	225.7
9	Pirrung	Doc MacKenzie	100.598	101.5	12.84	(2) 3-10	Miller 4	222
10	Milae	Chet. Miller	100.474	101.2	12.68	(3) 2-50	Miller 8	151
11	Miller-Hartz	Fred Frame	100.436	.....	.....	.....	Miller 8	181
12	Ring-Free	Louis Meyer	100.256	.....	.....	.....	Miller 4	255
13	Victor Gasket	Cliff Bergere	101.300	102.5 (197 laps)	11.58	(2) 3-15	Buick 8	294

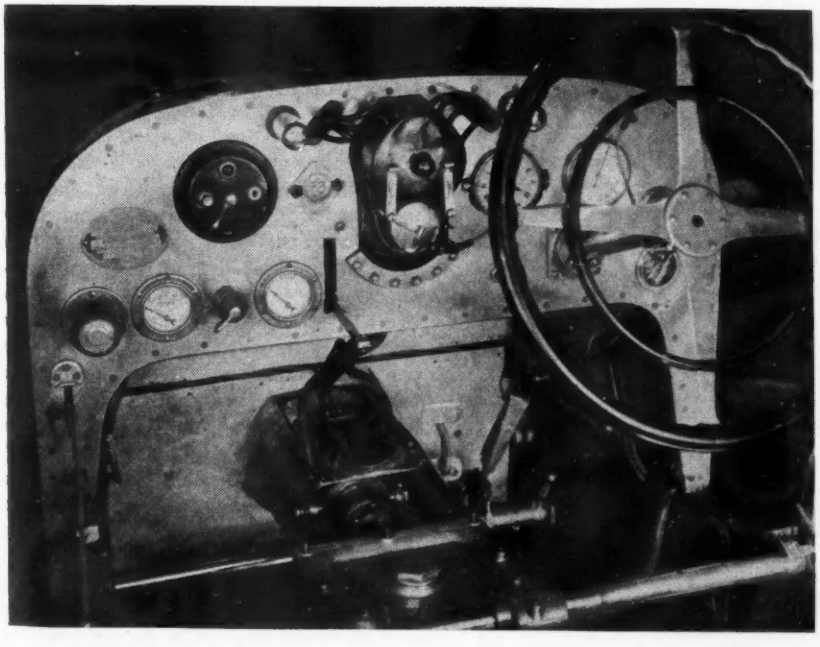
to put them in their engines this year.

But cylinder walls are not the only thing. Pistons and rings are an important thing. The latest development in rings are the so-called "Whafer" type that Perfect Circle have introduced. The racing piston according to their experience has very little cross head value. There is scarcely 3/16 in. of bearing surface beneath the lower ring and above the piston pin, on the best designs. This means that there is a decided rocking tendency with these pistons as the very short connecting rods with their excessive angularity reverse their angle at the top of the stroke. That is why Perfect Circle put a spring backed ring or rings in all the grooves except the top one. Into the latter they put a "whafer" type ring. The latter ring is wider than it is thick. These rings greatly reduce friction it is claimed and do a better packing job at the top. The explanation is this: The explosion pressure presses the spring down against the bottom side of the groove and getting in behind the ring expands it outwards against the cylinder wall. The wider the ring radially the smaller the area against which the pressure acts to expand the ring against the cylinder wall. At the same time the side area of the ring in contact with the piston ring land in the piston is considerably increased and the area on which the downward pressure of the explosion acts is larger. Hence the frictional resistance of the ring against the piston is greater and the tendency to expand against the cylinder wall is reduced. It also presents a longer travel for the gasses and therefore packs better. By properly proportioning the face and thickness it is possible to definitely affect the power output of an engine. This was learned in making piston rings for diesel engines where the high pressures behind the rings actually reduced power so much that the engines were not practical.

TABLE IV
Analysis of 1935 Qualification Trials
Arranged According to Speed

Position	Car No.	Car Name	Driver	Engine and Cylinders	Cu. In. Displ.	M. P. H.	Miles per gallon for 30 miles	Miles per gallon for 27½ mi. Est.
1	33	Gilmore	Mays	Miller 4	270.0	120.736	9.8	8.98
2	6	Cocktail Hour	Gordon	Miller 4	247.0	119.481	11.7	11.7
3	22	Abels-Fink	Roberts	Miller 4	255.0	118.671	9.8	3.0625
4	9	Sullivan-O'Brien	Cantlon	Miller 4	255.0	118.205	10.6	9.78
5	36	Ring Free	L. Meyer	Miller 4	255.0	117.938	10.4	9.56
6	1	Boyle	Cummings	Miller 4	221.0	116.901	10.2	9.41
7	14	Pirrung	Shaw	Miller 4	220.0	116.854	12.1	11.1
8	17	Marks-Miller	Stapp	Miller 4	255.0	116.736	11.4	10.48
9	2	F. W. D.	Rose	Miller 4	255.0	116.470	11.1	10.2
10	45	Bowes	Weatherly	Miller 4	220.0	115.902	10.0	9.17
11	44	Bowes	Gulotta	Miller 4	220.0	115.459	10.3	9.45
12	4	Boyle	Al Miller	Miller 4	255.0	115.305	10.5	9.68
13	21	Veedol	Hepburn	Miller 8	258.4	115.156	12.0	11.00
14	27	Duesenberg	Winnai	Miller 4	233.0	115.138	10.9	10.00
15	5	Gilmore	Petillo	Miller 4	262.4	115.095	10.2	9.37
16	19	Miller-Harts	Frame	Miller 8	181.0	114.701	11.4	10.48
17	18	Sampson	Gardner	Miller 4	220.0	114.556	9.8	3.0625
18	16	Shalits	Litz	Miller 4	225.7	114.488	10.6	9.8
19	37	Marks-Miller	Connor	Miller 8	250.0	114.321	9.7	8.9
20	8	Pirrung	MacKenzie	Miller 4	222.0	114.2 4	10.6	9.80
21	3	Boyle	Snowberger	Miller 8	270.0	114.209	9.9	9.08
22	7	Foreman	Moore	Miller 4	260.6	114.180	12.3	11.28
23	15	Victor Gasket	Bergere	Buick 8	294.0	114.162	9.8	8.98
24	34	Milac	Chet Miller	Miller 8	151.0	113.552	11.7	10.7
25	35	Ford V8	Bailey	Ford V-8	220.0	113.432	11.1	10.2
26	41	Art Rose	Brisko	Studebaker 8	250.0	113.307	10.5	9.68
27	43	Ford V8	Horn	Ford V-8	220.0	113.213	9.9	9.07
28	42	Ford V8	Seymour	Ford V-8	220.0	112.696	10.6	9.8
29	39	Blue Prelude	Snyder	Studebaker 8	337.0	112.249	9.6	8.8
30	62	Mikan-Carson	Insinger	Studebaker 8	337.0	111.729	9.7	8.9
31	66	DeBaets	MacQuinn	Miller 4	210.4	111.111	10.0	9.17
32	26	Burd	Tomai	Lenki 4	220.0	110.794	11.0	10.1
33	46	Ford V8	Sall	Ford V-8	220.0	110.519	10.6	9.8
				ALTERNATES				
34	32	Ford V8	Evans	Ford V-8	220.0	100.937	11.7	
35	56	Cresco	Andres	Cragar 4	214.0	100.074	12.5	

Miles run—30. One lap—warm up One lap—stop Ten laps qualifying



Bugatti dash showing magneto position and brake mechanism

Streamlining is naturally getting quite a lot of thought this year and the fairing of the cars is more carefully done than ever before. Probably the finest example of all is that found on the Wilbur Shaw Gilmore Special that made such a remarkable showing on gasoline consumption. Several pictures of this are shown so that it may be seen from all angles. The first unusual thing is the radiator position, or rather opening for the core is in its normal position ahead of the engine. The opening for air is at the bottom of the hood, which resembles in many ways the old Renault or Franklin. The opening is grilled and only shows about four inches up from the bottom of the pan and is extended under the car. The opening is connected to the front end of the radiator core by means of a metal cowling with rubber packing along its edge so that all air entering the grilled area will shoot up and through the core. The front underpan ends at the flywheel housing and the rear underpan is not connected to it but carefully faired into it so that in effect it is just like an N.A.A.C. cowling on a radial aviation engine. It remains to be seen whether

or not this outlet is sufficient outlet for a hot race day. On the driver's side of the body there is a cut away to allow easy entrance to the seats and give the driver elbow room but on the mechanic's side of the car the body is streamlined from front to rear without a break. Shaw has a transverse rear spring so that it is not necessary to put fairing over the rear springs. Where outside semi-elliptic or quarter elliptic springs are used either in front or back they are now completely enclosed on the best of the streamlined cars. This is particularly well done on the Pirrung and Dodge cars which were built during the past year.

The frame and chassis construction of the Gilmore job that Shaw drives has several other very interesting points of difference from other cars. The frame channels instead of being turned with the flanges inward as in conventional cars, are reversed. This makes it much easier to mount the engine and the cross-members which are tubular with flanges welded to their ends and bolted to the side channels. The driver and mechanic sit on a couple of these tubes which form the bottom of the frame and carry the seat cushion. That is how low the driver sits. The outward turned channels permit the placing of all fuel and pipe lines on the outside of the frame where they are convenient to inspect but do not clutter up the inside of the chassis. They are completely enclosed and protected by the underpan and the body. The underpan has an inwardly turned flange at the top edges and this hangs over the top flange of the frame finishing off the chassis as smoothly as a duck's back. The body and the hood set down on top of the frame and are flush with the underpans. A transverse rear spring of the Ford type makes spring housings unnecessary with this design. Without a doubt it will set the style for next years' cars.

A good streamlined car, however, must have good brakes for there is insufficient wind resistance to slow a car down for the turns. Shaw has provided unusually large brakes with steel drums machined with cooling and reenforcing grooves on their exterior. All brakes are of the internal expanding type. The foot and hand brake are interconnected, either one serving to apply all four brakes. The brakes are of the hydraulic type but with one distinct difference from ordinary hydraulic brakes. One cylinder operates the rear brakes and another the front brakes. The front master cylinder is attached to the pedal, the rear to the hand lever, thus reducing the pipe lines to a minimum. In case of failure of either front or rear, only two brakes will be lost.

Rubber is being used in numerous places on a lot of the cars. For example, the steering wheel of Shaw's car is steel, but the rim is covered with sponge rubber. It is very nice to look at and he thinks it saves his hand from vibration fatigue. So many of the cars have Dunlopilo cushions. Whether they go through the race with them is another question. They may be too soft, but many of the boys are experimenting with them.

Results of the 500-Mile Race

will appear with complete engineering detail in the next issue of Automotive Industries. This year the day of the race coincided with our Saturday publication date, for which it is necessary to go to press two days in advance.

To the automotive engineer who wins the race is not so important as what kind of car and how it performed against the field. Satisfying details on the latter points will be available in the June 6 issue from W. K. Toboldt, another member of the A.A.A. technical committee.

The Bugatti has a number of very interesting technical points. The brakes are cable-operated and equalized from front to rear on each side and from side to side. A differential gear is placed on the brake pedal and chain equalizers are used on each side.

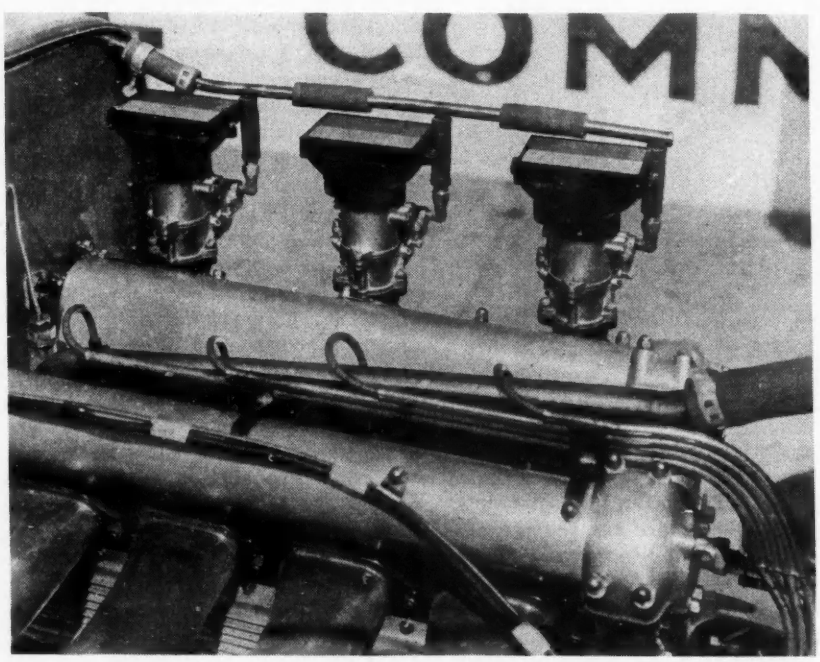
The three-valve engine, although it has small valves, two intake and one exhaust, is provided with oil-cooled exhaust valves. The valves are in the head and operated from a single camshaft along the top of the head. Rocker arms between the camshaft and the valves are anchored on the side of the camshaft housing. Bevel gears are used to drive the camshaft through the intermediary of a vertical shaft at the front end of the engine.

Quarter elliptic springs at an angle at the rear support the frame. The drive is through radius rods. The French Hartford shock absorbers at the rear are inside of the frame and the arms are connected together with a torsion bar stabilator. The mechanics told the writer that this had been used with the quarter elliptic Bugatti springs for the last ten years.

The torque arm which parallels the driveshaft is suspended on leather links, as are the shock absorbers. They are heavy laminated leather units.

Lou Moore has a Studebaker independent front wheel suspension with

(*Turn to page* 778, *please*)

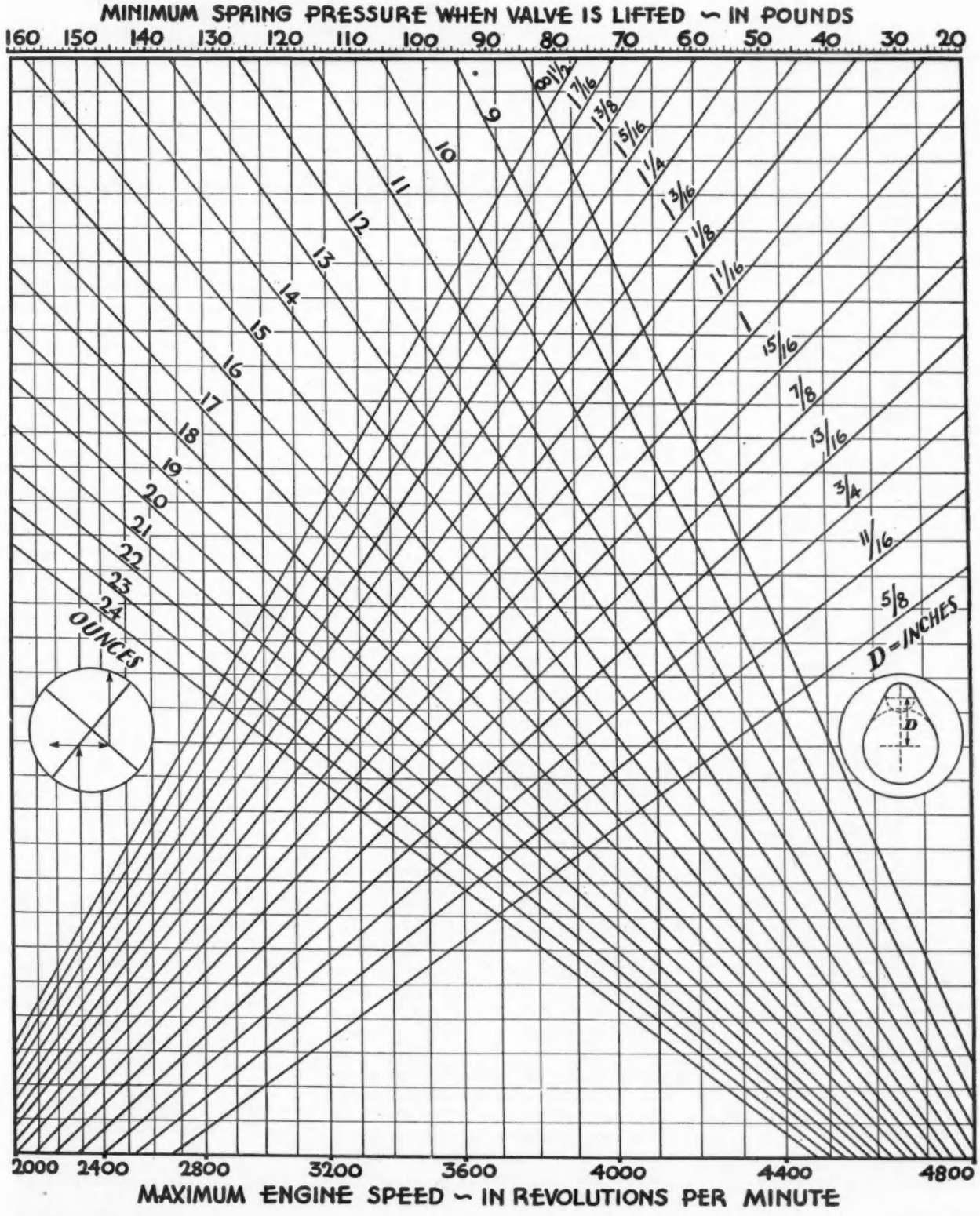


New Zenith carburetors with four jets for burning heavy fuel

Valve-Spring Pressure Required With Mushroom-Follower Cams

(Automotive Industries Engineering Chart Redrawn to Cover a Wider Speed Range)

IN order to determine the minimum pressure required in valve springs for use in connection with the ordinary mushroom type of cam follower, and the corresponding cam, locate the maximum engine speed on the bottom scale, proceed upward to the inclined line representing the center distance D between the base and top circles of the cam; thence horizontally to the inclined line representing the weight of the valve reciprocating parts, and thence vertically to the scale at the top, where the value desired may be read off.



ABSTRACTS

of S.A.E. papers built around the Summer Meeting Theme: "Engineering for Safety and Economy in Automotive Transportation"

A Cathode-Ray Indicator

A NEW cathode-ray engine indicator and applications of it in engine research were described by E. M. Dodds of the Anglo-American Oil Co., Ltd. The pressure element of the indicator is of the carbon-disc type and is illustrated by Fig. 1. It has a body, *A*, machined from the solid in stainless steel. Screwed into the stainless body is a boss, *B*, which carries a central electrode, *C*, suitably insulated by means of silica tubes, *D*. The lower enlarged end of this electrode is ground flat and contacts with the upper surface of a stack of thin carbon discs, *E*, about 3/16 in. in diameter and 3/16 in. high. This assembly is shrouded by means of the rubber tube, *F*, allowing the complete element to be water cooled without interfering with the electrical circuit. Initial adjustments are made by screwing in the member *B*, which is locked in position by the locknut, *G*. As a result of water cooling, temperature "creep" of the resistance element is eliminated, and, at the same time, the mechanical properties of the stainless steel are preserved.

The pressure element is connected in circuit with deflecting coils on the neck of the cathode-ray tube. There is no need for amplification, and the height of the diagram obtained is a function of the battery voltage. The timing mechanism, which is driven from the crankshaft, is similar in design to an ignition breaker, but involves a separate set of contacts on the upper side of the breaker arm. One or the other pair of contacts is selected by moving the complete stationary contact around the axis of the contact-breaker arm, thereby ensuring good contact operation at all settings. When the conventional pair of contacts is in use, the diagram obtained represents 350 deg. of a complete rotation, the remaining 10 deg. corresponding to the period of "make." When the upper pair is in use, only a small portion, 20 deg. for instance, is selected, the contacts remaining closed during the other 340 deg. The breaker mechanism is connected to a timing-base unit consisting of a condenser which is charged at any desired rate by means of a variable resistance, and short-circuited once each rotation by the breaker. Two neon tubes are connected in series across the condenser to prevent the attainment of dangerous voltage between the plates of the condenser; they play no part in the regular operation of the timing circuit.

Among the applications of the instrument dealt with in the paper is that in the determination of ignition lag in Diesel engines. By rotating the breaker so as to bring the point representing

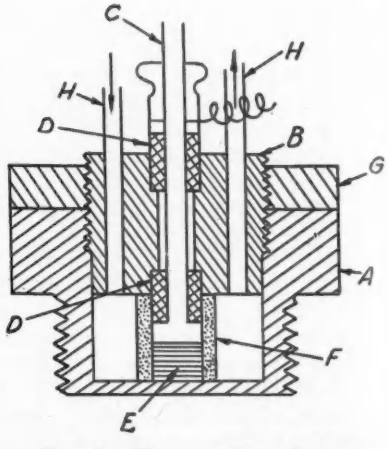


Fig. 1—The pressure element

Innovations scheduled for White Sulphur meeting include unreported session for S. A. E. members only; forty technical papers cover all phases of automotive engineering, with unusual emphasis on the developments of tomorrow; many top executives expected to attend with total registrations exceeding last year's high figure

commencement of injection into coincidence with a given datum line on the tube screen, an arbitrary crank angle is noted. If the breaker is once again rotated until the point representing the commencement of combustion coincides with the same datum line, the difference between the two crank angles represents ignition lag of the fuel in degrees, obtained in a few seconds to the accuracy of a protractor scale. In the same way, the frequencies involved in an oscillogram may be read off directly by bringing each wave crest in turn on to the datum line, and reading the angular differences from the protractor. Knowing the engine speed, the time in seconds between the crests can thus be found, and hence the frequency.

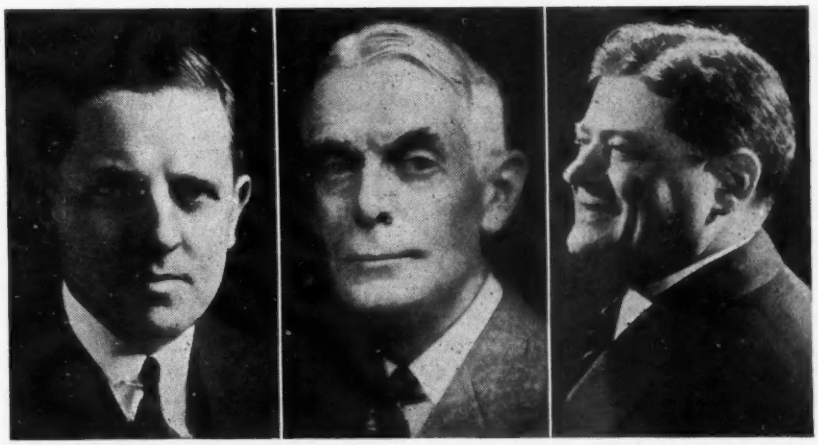
Another problem studied by means of the instrument was the origin of the sound in detonation. The cathode ray tube was coupled successively to microphones located in three different positions, as follows: (1) suspended in the air near the engine; (2) mounted in sponge rubber contacting with a part of the cylinder head, and (3) mounted in the combustion chamber. A qualitative study of the oscillograms obtained under the three conditions showed the audible sound obtained during detonation to be due to the ring of the metal cylinder when struck internally by the steep pressure rise. Internal pressure waves in the gas did not involve anywhere near the same frequencies as the audible sound.

Mr. Dodds also made a study of the causes of Diesel-engine knock and in this connection made use of a dual injection pump. The first pump was set to inject roughly one-fifth of the quantity of fuel representing full load injection. Just after ignition occurred, the second pump injected the remaining four-fifths, or less, into the resulting flame. This enabled quiet combustion with excellent power output to be obtained on the poorest of fuels, and the author suggested that the same result might be achieved on production engines with a single pump incorporating a double step cam.

The author, moreover, expressed the view that the widely accepted theory that Diesel knock is principally dependent on the amount of fuel injected before ignition takes place is not the whole story. In many cases the indicator shows a large proportion of the fuel charge to be in the cylinder prior to ignition. This ties up with the fact that alterations in the physical properties of a particular fuel, by application of heat to the fuel line, for example, have little or no influence on the knock intensity, although very marked changes take place in the injection distribution per degree crank angle, as shown in injector-valve-movement oscillograms.

The following explanation was of-

Dynamics of Discussion



will get full rein at Tuesday evening S.A.E. "Members Only" session, June 2, with K. T. Keller (right) as chairman, and Paul G. Hoffman (left) and Henry M. Crane as co-chairmen. Discussion at the session will be unreported, and it is hoped, unrestrained

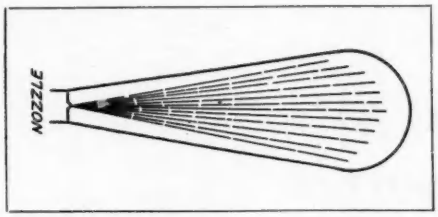


Fig. 2—Stainless steel cone to give air swirl on nozzle face

fered by the author as to why fuels of high compression-ignition temperature knock more in a Diesel engine, when from experience with gasoline engines they would be expected to knock less: When a good paraffinic fuel has been injected, combustion commences some degrees after the start of injection, but before turbulence has had time to assist the mixing of air and fuel, so that there results a distribution roughly as shown in Fig. 2, in which, near the axis of the cone of spray, there is a very rich mixture, and near the chamber walls, practically clean air. It is obvious, therefore, that the greater part of the charge is either too weak or too rich to burn rapidly, and so high rates of pressure rise never manifest themselves, in spite of the fact that the fuel is paraffinic.

Turning now to the case of a bad naphthenic fuel, with which combustion commences much longer after the start of injection, turbulence now has sufficient time to assert itself, which results in a mixture far more homogeneous than that of Fig. 2. Much higher rates of pressure rise would therefore be expected with fuels of long ignition lag, even though the anti-knock value of such fuels is higher than that of the paraffinic fuel by gasoline-engine standards.

Results of Inadequate Cooling

CYLINDER Temperature was the subject of a paper by Macy O. Teetor, of the Perfect Circle Co., which dealt chiefly with the harmful effects of inadequate cooling of portions of the cylinder bore. One outstanding development in internal combustion engines has been the constant increase in the output per unit of displacement or of weight. The additional heat generated as a result of this improvement has been difficult to handle. That the temperature of the cooling water does not run above 160 deg. F. or the fin temperature above 300 deg., does not mean that there are no excessive temperatures on the inside of the engine, according to Mr. Teetor. Such excessive temperatures reduce the efficiency and the life of the engine.

Considerable thermal distortion takes place in cylinder blocks, and the associated evils—blow-by and excessive oil consumption—have become more pronounced during the past few years because of the increase in speed and in specific output. Cylinders having different distortion characteristics have different blow-by characteristics. Of course, many factors affect blow-by, but cylinders having the least thermal distortion tend to show the least blow-by and will operate at higher speeds before the characteristic break in the blow-by curve appears.

The surface of the piston ring in contact with the cylinder wall must be supplied with a sufficient amount of oil to prevent metal-to-metal contact between the rings and the wall. Lubricant in a cylinder must serve two purposes, acting as a sealing means between piston and cylinder wall and also preventing metal-to-metal contact between the two. Cylinder distortion localizes pressure between the faces of the piston rings and the cylinder wall, thereby upsetting the uniformity of the oil-film thickness. If the film is too thick, the pressure from the combustion chamber will break through; if it is too thin, the outward pressure of the ring will break through, and both conditions can occur in the same cylinder.

It has been observed that when the surface temperature exceeds 400 deg. F. a breakdown in the lubrication may be expected, permitting metal-to-metal contact between rings and wall. The resulting damage to the face of the piston rings and the cylinder wall depends upon conditions of operation. If the engine is operated for some time under full load at high speed, the usual result is a completely scuffed cylinder, piston and ring assembly. The rings passing over the hot area scuff and carry the destruction to the rest of the cylinder, which in turn scuffs the piston. In some engines a constant process of scuffing and smoothing up is going on, accompanied by high oil consumption, blow-by and excessive wear.

The material out of which the piston rings is made is not the only controlling material factor in the problem. Cylinders that are cast integral with the block are structurally different from top to bottom. This structural difference is largely caused by the cooling rate of the iron when the casting is made. The structure that is found at the top of the barrel where it joins the roof is different from the structure in the middle of the barrel.

Fig. 1 shows the cylinder surface temperature of three different cylinders, run on the same engine, with operating conditions held as nearly uniform as possible. The thermocouple was located in the center of the top-dead-center position of the top compression ring in each cylinder. Cylinder A was of conventional design with respect to water circulation and size and arrangement of passages. Cylinder B was produced by re-designing Cylinder A, improving the water circulation around and between the valves. Cylinder C (Fig. 2) was designed with the intention of eliminating cylinder distortion and hot spots as nearly as possible by locating the combustion chamber in the top of the sleeve. Advantages secured from this design were greater flexibility between roof and the cylinder barrel, and water circulation around the cylinder the full length of the area traveled by the piston rings.

Commenting on the results obtained with the three cylinders, Mr. Teetor said the surface temperatures of Cylinder A were excessive, well above what experience indicates to be safe. Scuffing to some degree was noted throughout the test and severe scuffing occurred at 4000 rpm. Oil consumption was considerably higher and blow-by slightly higher than with the other two cylinders. The temperatures of cylinders

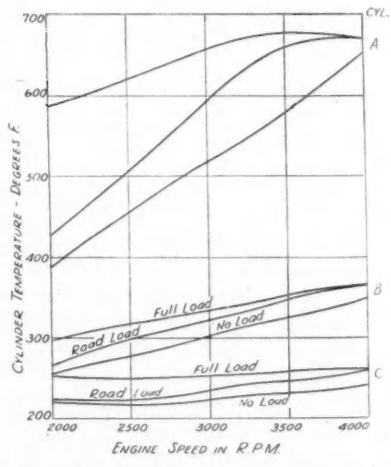


Fig. 1—Surface temperature of three water cooled single cylinders

A—Conventional water circulation. B—Cylinder A re-designed with improved water circulation around and between valves. C—See Fig. 2 for design details.

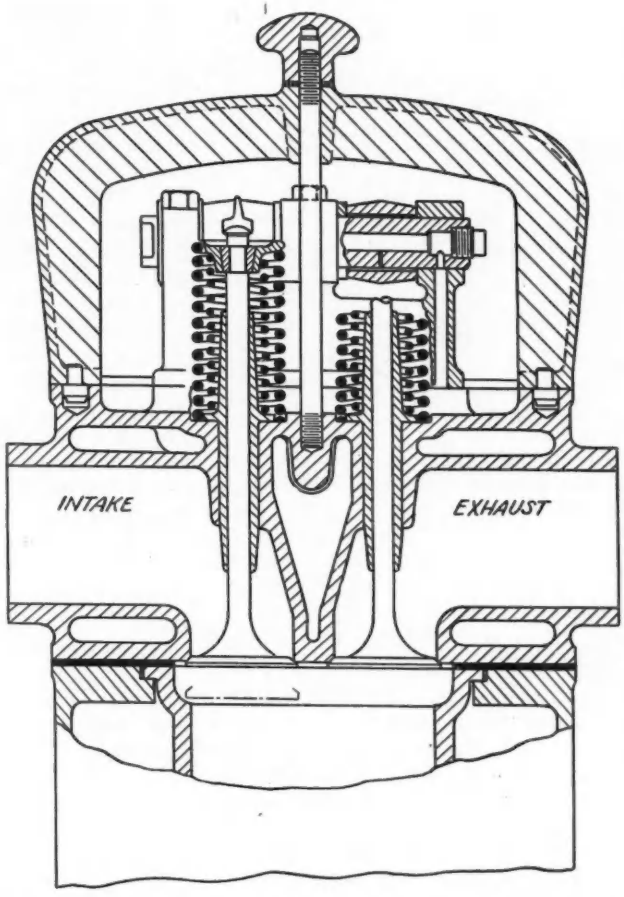


Fig. 2—Section of cylinder C, showing details of sleeve construction

B and C seemed to be well within safe limits, because scuffing or distortion was not apparent in either cylinder, while the temperatures of cylinder C appeared to be almost ideal, judged by the performance data.

Stiffer Chassis Frames

METHODS of increasing the torsional stiffness of chassis frames without adding to the weight were discussed by D. W. Sherman, of the A. O. Smith Corporation, in a paper on "The Chassis Frame." Mr. Sherman pointed out that the problem of securing adequate stiffness in frames is particularly acute in open cars. He mentioned a standard 1935 closed car with steel top and trunk which had a torsional stiffness of 10,300 lb-ft. per deg., while the torsional stiffness of its frame alone (a conventional X frame weighing 265 lb.) was only 1225 lb-ft. It was found possible to replace the standard frame with one having the torsional stiffness of the complete car without increasing frame weight.

In discussing the two basic frame types, the tubular and the channel-section type, the author came to the conclusion that if torsional moments alone had to be resisted the tubular type would have the advantage, but there are also bending stresses to be taken care of, and a circular section is not advantageous for bending loads. Any departure from a circular shape to effect a compromise results in a great loss in torsional resistance.

A study of the conventional X frame led to the conclusion that its low torsional rigidity is due to the impossibility of getting a good center-connection design. Large, heavy plates, with a great number of connections, would improve the condition, but a heavy weight penalty would result, and in many cases clearance requirements would not permit of their use. The channel used for the X members is naturally unbalanced and cannot always be braced where necessary, and weakness of the center joint results in most cases from the lack of symmetry of the channel. Because of the need for lightness, the channels are made of light material, with the result that the flanges when loaded in compression react as slender columns with insufficient support. In some designs, moreover, the flanges are not laid out straight but are curved to clear exhaust pipes, etc., in which case the buckling action is greatly aggravated. It was found, moreover, that the material in the conventional panel frame is not properly distributed. The side rails are made of heavier section than the X member, and in some cases they are of greater depth, notwithstanding the fact that the X member is subjected to a greater bending moment. Consequently, the material distribution should be just the reverse of what it is in conventional frames.

In the frame developed by the A. O. Smith Corporation use is made of I sections for the X member, built up from strip stock flanges and a flat web, by means of arc welding. (Fig. 1.) The X member was made as deep (10 in. at the center) as ground-clearance requirements permitted, and this depth was carried well away from the center and then reduced rather abruptly to match the side-rail depth. The inner ends of the arms of this experimental

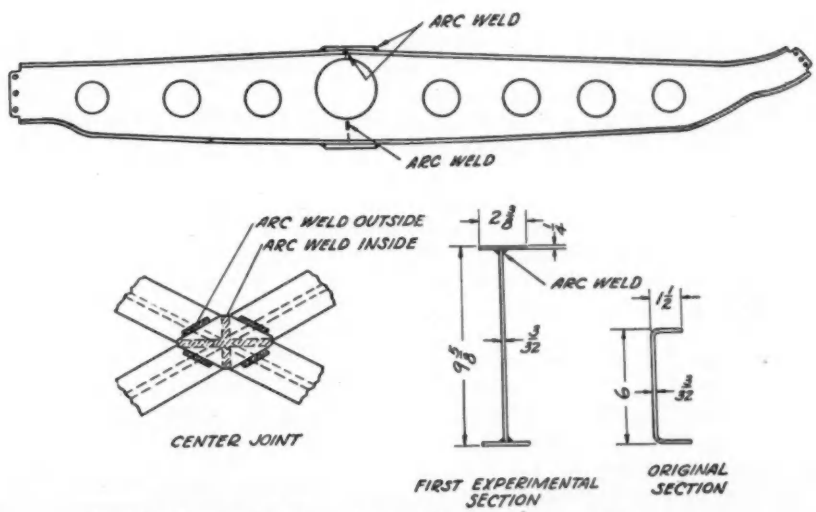


Fig. 1—Frame built up by welding described in the paper of D. W. Sherman

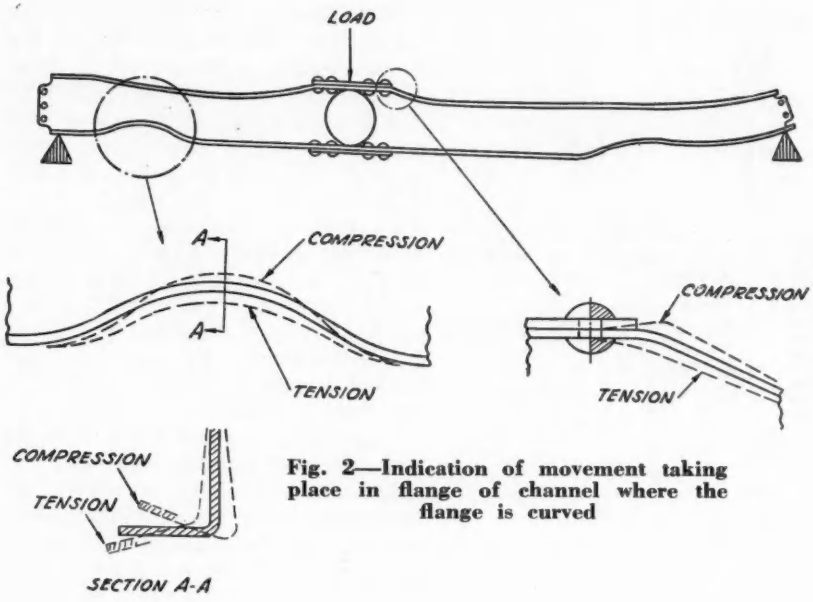


Fig. 2—Indication of movement taking place in flange of channel where the flange is curved

member were brought directly in line with each other, and the junction made by arc-welding, along with the use of two small diamond-shaped plates, these plates acting as local reinforcements to make up for the web cut-out required for propeller-shaft clearance, and also as dams to facilitate deposition of weld material.

As a preliminary step, the X member was removed from the standard frame and replaced by the I-beam type. No other changes being made, the torsional stiffness of the frame section between the front and the rear end of the X member was multiplied about ten times and that between the front end of the X member and the front axle, about three times.

This frame was built into the car and various tests were made. As a result of these tests, many changes were made in the frame to increase its stiffness, and the effects of these changes on the performance characteristics were determined. The design of the final frame was based on this test work.

The standard frame had 6 x 1¾ x 9/64 in. side channels and an X member made of 6 x 1½ x 3/32 in. channels. The rear kickup was boxed in from the rear end of the X member to the gasoline tank with a 5/64-in. reinforcement, and the forward end of the side rails was boxed in from the front end of the X member to the front cross member. The weight of this frame complete was 265 lb. and its torsional stiffness between the front and rear ends of the X member was 1225 lb-ft. per deg., and between the front of the X member and the front axle, 1360 lb-ft. per deg.

As compared with these dimensions, the experimental frame had 7 3/16 x 1¾ x 3/32-in. side rails and an X member composed of I beams 10 in. deep with 3/32-in. web and 2⅜ x 3/16-in. flanges. The rear kick-up had no boxing and only a small reinforcement at the center, while the front end of the side rails was boxed from the end of the X member to the center of the front axle with 5/64-in. stock. This frame weighed 264 lb. and showed a torsional stiffness of 7000 lb-ft. per deg. between front and rear of the X member, and 3400 lb-ft. per deg. for the section from the front of the X member to the front axle.

Because of the great gains in stiffness it was decided to develop an I section which could be produced cheaply enough for commercial purposes. The flanges are special rolled T sections, the web is ordinary flat stock blanked to shape. The flanges, after being formed to the proper shape, are flash-welded to the web sections. No accurate comparison of the gain in stiffness per unit of material used, in the new X member as compared with the standard one, has yet been made, but the weight of the former is 78 lb., compared with 51 lb. for the latter.

In Fig. 2 is indicated the type of movement which takes place in the flange of the channel where the flange is curved. With an I beam section this flange-buckling tendency seems to be greatly reduced. If the beam shifts sideways, the flange of the channel can deflect in a vertical plane only, as otherwise a shearing action would have to take place in the fibers adjacent to the web. With the I section, there are equal and opposite lateral resistances on both sides of the web, consequently, the web maintains its alignment and the flanges remain in their proper locations and resist tension and compression resulting from vertical bending loads.

When the frame is rigidly secured to the body structure, the action of each unit under torsional load is modified by the other. When each part is separately subjected to torsion, movement will take place around an axis about which the resistance to torsion is a minimum, which is somewhere near the geometrical center of the section. If the two parts are secured together and loaded torsionally, angular movement takes place about an intermediate axis. In consequence, when the stiffness of the frame is increased, the axis of twist of the combination is brought closer to the frame, the contribution of the frame to the over-all stiffness of the assembly is more nearly the same as its individual stiffness, and the body, because of the greater distance between its axis of torsion and that of the assembly, contributes more to the stiffness of the assembly than it did

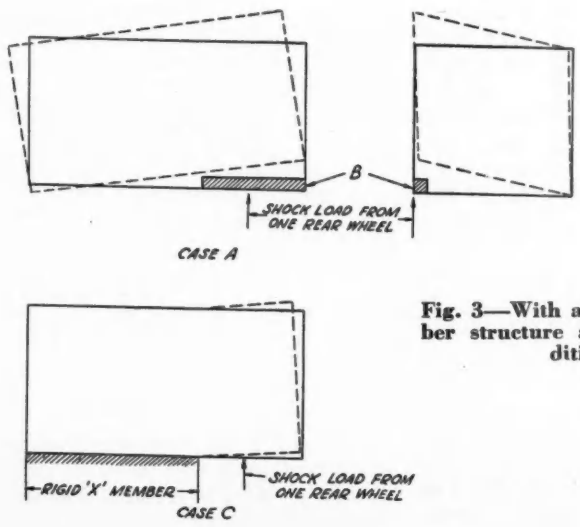


Fig. 3—With a more rigid X member structure approaches the condition at C

with the weaker frame. Therefore, if the torsional stiffness of the frame were to be increased, say, 1000 lb-ft. per deg., the torsional stiffness of the assembly would be increased more. Thus in the standard car the frame between front and rear ends of the X member had a torsional stiffness of 10,330 lb-ft. per deg., the stiffness of the frame alone being 1225. By increasing the frame stiffness to 7720, the stiffness of the assembled car was increased to 20,060. Thus while the increase in the frame stiffness amounted to only 6495 that of the complete car was increased 9730 lb-ft. per deg.

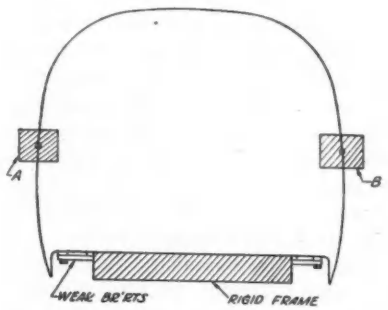


Fig. 4—Here is a cross section of a frame assumed to be infinitely rigid

Increase in the stiffness of the X members seemed to reduce the movement in the rear end when the car was driven over rough pavement, in almost direct proportion.

Next certain tests were made to obtain information as to the effect on the relative stiffnesses of frame and body at the rear when stiffness was added at at front. Each unit was mounted on a surface plate, the rear end overhanging from the rear end of the X-member back, and torsional and vertical loads were applied.

In a conventional car, with comparatively weak X-members, torsional body deflection takes place somewhat as indicated at A in Fig. 2—the deflection being greatest at the rear because of the greater frame stiffness at the forward end of the body, due to boxing of the front end of the frame. Body deflection results from deflection in the body corners; the top, floor, and sides moving in relation to each other as units.

Boxing of the rear kick-ups can be likened to the addition of a small torsion member to the body, as indicated by B. Naturally, this addition will influence the stiffness of the body, but if of the proportions shown, its effect must be small. An increase in beam stiffness of the kick-up can have practically no effect, adding only very slightly to the bending stiffness of the body side walls, and the deflection takes place, not because of a weakness in the side walls, but because of deflection in the body corners.

Torsional Frame Stiffness

No.	Name	Weight	Lb.-Ft. Torque per deg. Deflection: Rear of "X" to Front of "X"	Lb.-Ft. Torque per deg. Deflection: Front of "X" to Front Axle Center Line
1	Standard X-Member Type Frame	265	1,225	1,360
2	Same as No. 1, but Holes in Front Sub-Channels Closed	271	1,250	1,440
3	Same as No. 2, but Front Member Boxed	276	1,275	1,575
4	Same as No. 1, but Channel X-Member Replaced with I-Beam X-Member	302	12,225	4,050
5	Replacement Frame for No. 1, I-Beam Type X-Member	246	7,000	3,400
6	Standard X-Member Type Frame	212.5	440	760
7	Replacement Frame for No. 6, I-Beam Type X-Member	173	3,730	1,690
8	Side Rails and Front Member from No. 6, I-Beam Type X-Member	145	3,530	2,090
9	Standard Frame, Tubular Type	170	600	828
10	Replacement Frame for No. 9, I-Beam Type X-Member	160	2,450	2,425

With a more rigid X-member the structure approaches the condition shown at C, Fig. 3; the corner deflection in the body is eliminated over the area encompassed by the four ends of the X-member, and deflection takes place only from the X-member back. Torsional loads applied at the rear are resisted by the vertical bending stiffness of the body side walls, these acting as extensions from the portion of the body supported by the X-member. Under these conditions, vertical stiffness added to the frame kick-up would cause a further increase in tail-end rigidity. However, the body rigidity is already several times the rigidity of the frame, so great increases would be necessary to obtain any large percentage of improvement.

The stiffness of the front end of the frame is of importance, as its vibrational frequency has a decided effect on the dynamic problems associated with the front-wheel suspension, flexibly mounted motor, etc. Apparently, the vertical stiffness of the side rails is of major importance, experiments indicating that the lateral stiffness does not have nearly as much effect in quieting the front end.

With the conventional frame, having comparatively weak X members and heavily boxed front side rail extensions, the front end of the frame in many cases is stiffer torsionally than the portion back of the dash. In this case the side rail section to the rear acts somewhat as a cantilever supported by the forward end of the side rail. With a stiff X-member this condition is reversed, the front end extensions functioning as cantilevers supported at the dash.

A check on the stiffness of the frame alone is useful only for making design comparisons. The actual overall result must be obtained by a check on the frame and body assembly. It is possible, for instance, to add stiffnes to the X-members and have greater stiffness in the car from dash to front axle, even though the side rails are actually weaker through this section.

A torsionally rigid frame is of little avail if the body attachment is not properly made. After all, the main function of the chassis is to properly support the body weight, and it is this weight, primarily, which is responsible for the torsional loads which are imposed upon the frame structure; a chassis without the body, driven over rough pavement, would be punished very little.

In Fig. 4 is shown a cross section of a frame assumed to be infinitely rigid. Brackets extend outwardly to act as supports for the body. These brackets are deflected by the body weight, supposed to be concentrated at A and B, and act as springs. As a result, objectionable natural frequencies are set up. It is therefore necessary that the body be supported adjacent to the four X-member extremities, and that the supports be secure. Intervening supports, of course, must be used for stopping body-sill deflection at the door openings.

Table I shows the relative stiffness of various standard frames as compared to replacement frames having an I beam X-member.

Vapor Lock Still Important

VAPOR lock seldom occurs in cars of current model, because it is provided against in the design of these cars, but it is still an important problem to the petroleum industry, which must furnish fuels suitable for use in all cars in service. In cars of recent manufacture provision is made to allow

any vapor that may form in the fuel system to vent off before it reaches the metering orifice of the carburetor, and the situation has been helped also by the petroleum refiners producing gasoline to meet compromise front-end volatility specifications. However, all gasoline vapor that is thus vented off represents a direct waste of fuel, and Everett M. Barber and B. A. Kulason, of The Texas Company's Beacon Research Laboratory, who have prepared a chart for the solution of vapor-lock problems and presented a paper on it at the meeting, alleged that in some cars this loss amounts to as much as 10 or 20 per cent of the total fuel supplied to the car. Furthermore, the forced compromise on the front-end volatility characteristics causes a waste and diversion of much of the lighter gasoline fractions that are present in the crude but which cannot be used in gasoline manufactured to meet the required volatility specifications.

The Vapor Lock Chart presented by the authors is designed to serve as a suitable common basis for the solution of vapor lock problems. By means of this chart it is possible to specify the fuel-system temperatures required to prevent both vapor lock and excessive fuel losses when using a gasoline of which the volatility characteristics are known in terms of the Reid vapor pressure and the initial range of the A. S. T. M. distillation. Conversely, it is possible to specify the fuel for a car or group of cars of known vapor-locking characteristics.

Engine Types and Fuel Requirements

IN a paper on Engine Types and Fuel Preparation Requirements, F. C. Mock of Bendix Products Corporation divided the available motor fuels into five classes according to volatility. Fuels boiling below 280 deg. F. can be used in carburetor engines under all normal atmospheric conditions without heat application to the manifold. Fuel blends boiling between 140 and 360 deg. F. can be used in a carburetor with a heated inlet manifold. Heating of the charge results in a small power loss and this loss can be avoided by:

(a) injection into the properly designed supercharger of a radial engine;

(b) timed injection into the intake pipes of nearly any form of engine;

(c) injection into the cylinders.

With the systems referred to under (b) and (c) special means for mixing the air and fuel are usually needed.

Fuel blends boiling between 200 and 450 deg. F. are adapted for injection into the cylinder during the intake stroke, which leaves the remaining part of the intake and the whole of the compression stroke available for diffusion. Special means for increasing the natural turbulence are usually required.

It was only with the above three classes of fuel, Mr. Mock said, that he had found it possible to utilize the whole air charge of the cylinder for combustion and to obtain the full m.e.p. of which the engine was capable, and when this was achieved, detonation depended merely upon the octane rating of the fuel.

Fuels boiling between 300 and 560 deg. F. must be injected late in the compression stroke, and the compression ratio must be raised above 6 to 1 to assure proper combustion. This involves higher compression ratios than possible with the more volatile fuels without detonation, but permits pressures materially below those necessary for compression ignition. Owing to the short time available for the diffusion of the fuel in the air, it seems impossible to utilize the whole of the air charge for combustion, and the b.m.e.p. is lower and the fuel consumption higher than would be expected in view of the compression ratio used. An important problem with this type of engine is to obtain the proper mixture around the spark points at the time of ignition.

Fuels boiling above 560 deg. F. can be used only in compression-ignition engines. With these fuels the m.e.p. has so far been limited, in the author's opinion, because of lack of sufficient time for mixing the fuel and air before combustion starts. In its most successful form it seems to give the lowest consumption, but except at light loads it does not give the same high economy as the first three classes, when allowance is made for the higher compression used. It must not be forgotten, however, that the heat value of Diesel fuels is usually about 10 per cent less per pound than that of the more volatile fuels.

Recent developments in aircraft powerplants have initiated a radical change in carburetor forms. The mixture proportion will be corrected automatically for both air density and temperature, and according to cooling requirements under heavy or emergency load. The fuel discharge jets will be brought nearer the supercharger, and older methods of fuel metering may be superseded by more or less automatic devices. This change in practice, incidentally, will minimize ice formation in the carburetor.

For the second class of fuels, spray into the supercharger holds considerable promise, but minor changes in supercharger design are called for. In the first place, the fuel must be injected centrally into the supercharger, as otherwise it will not come out equally

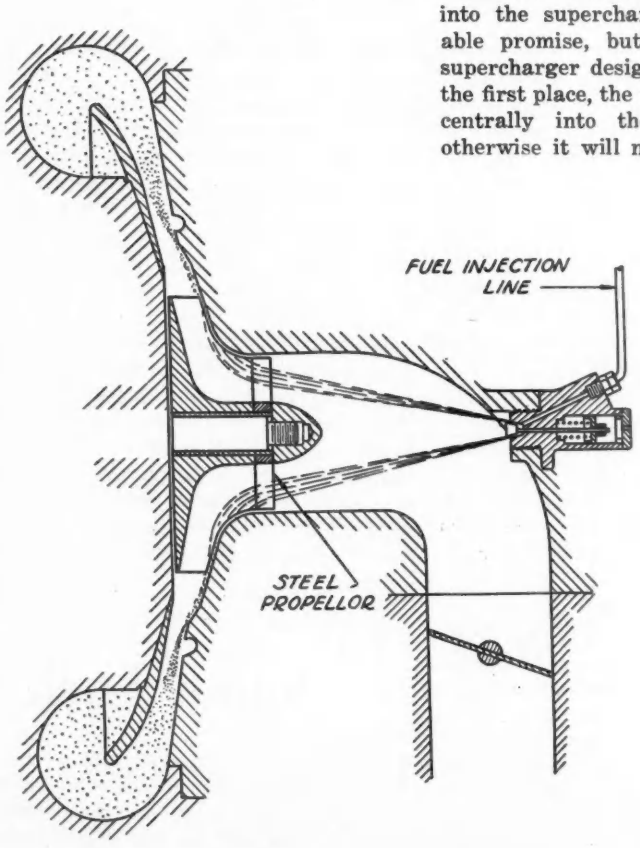


Fig. 1 — Recommended design for injection into the supercharger

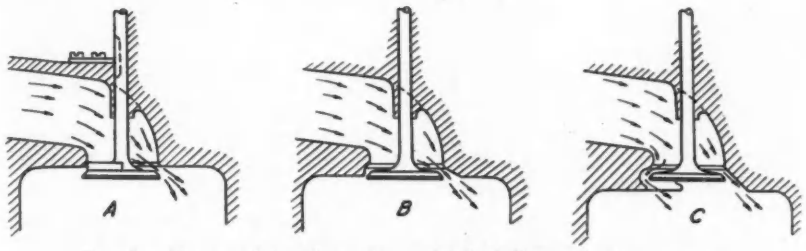


Fig. 2—Types of intake valves which deliver air unsymmetrically into the cylinder spaces

A—"C.F.R." or "Hesselman" intake valve with shroud on head. B—"Ricardo" valve with shroud. C—"Gehres" intake deflector

around the periphery. Stationary vane diffusers around the supercharger wheel should always terminate symmetrically with reference to the different intake outlets from the ring manifold; in the lower range of operating temperatures encountered, the fuel, though atomized when leaving the wheel, may condense again when it strikes these diffusers, and is washed along them, leaving their outer tip in low velocity trickles of coarse drops, which tend to pass directly into the nearest intake-pipe opening.

Fig. 1 shows a device for reatomizing this trickle, also a type of diffuser which seems to give particularly good fuel distribution. It involves the disc or flat-venturi type of expansion chamber, with a groove or reentrant whorl and sharp edge terminating the inclined surface on which the fuel collects as thrown off the supercharger wheel. The fuel flies off this sharp edge into the passing air as a very fine spray. Mr. Mock said this type of supercharger diffuser was more efficient than the vane type and he gave several reasons for considering it so.

With timed injection into the inlet manifold a major problem is to insure that throughout the intake stroke of a given cylinder, the fuel and air deliveries into the cylinder continue in equal ratio. Another difficulty encountered is that while the fuel spray in suspension in the air stream may travel right along with it, a large amount of the fuel tends to deposit out at the bends and thereafter travel toward the engine on the intake walls, lagging greatly behind the air. This points toward the need of special means for inducing swirl or turbulence in the cylinder. Fig. 2 shows three intake-valve constructions which give this effect:

(a) The "shrouded" intake valve long used in Diesel practice and now popularized in the Hesselman and CFR engines;

(b) A modification proposed by Ricardo which avoids the necessity of holding the intake valve against rotation and

(c) A method proposed by Gehres, which has the advantage of allowing practically unobstructed air flow through the valve orifice, which the two former examples do not.

Types (a) and (b) give the greatest tendency toward swirl at the beginning and end of the valve opening, while (c) gives the highest swirl effect during the middle of the intake stroke, a matter which sometimes is important in connection with fuel injection timing.

The author said it had often been suggested that a possible reduction in fuel consumption at cruising speeds might be obtained (with cylinder injection) if the fuel-vapor charge could be concentrated around the spark plug points, so as to permit cruising at one-half to three-quarter rated power with the throttle fully open. While he had been able to approximate this condition, he had never improved the fuel economy thereby. He had been able to operate engines smoothly on a 21:1 mixture, but the fuel consumption was not as low as with a 16.5:1 mixture.

In engines with fuel injection during the compression stroke, with spark ignition, it is practically impossible to utilize all of the air for combustion, owing to the short time available for mixing the air and fuel previous to ignition, and the m.e.p. will therefore be relatively low. The engineer therefore endeavors to obtain the earliest injection, the best diffusion of fuel, vapor and air, and the best mixing turbulence compatible with maintaining an ignition mixture of not too high velocity around the spark-plug points.

A compensating factor is that the compression ratio may be raised with less detonation than if all of the air were utilized—which tends toward lower fuel consumption.

To those experimenting with this type of engine Mr. Mock suggested that they try operating with a carburetor and high-octane gasolines, at compression ratios of 6, 8, and 10, with the throttle opened only to the detonation point, and plot the so-called "fishhook" curves of power vs. fuel consumption obtained by varying the fuel setting. His own experience had been that the thermal efficiency was always higher with the carburetor than with injection, and he believed this tendency continued in the range of higher compressions.

Mr. Mock expressed the opinion that if consistent ignition could be obtained, this type of engine would show at least the same weight efficiency and the same fuel economy as the compression-ignition engine; but this would require that the fuel charge be definitely segregated in a part of the compression space near the spark plug. Theoretically this would reduce the detonating tendency to a minimum, in that there would be nothing but air in the part of the combustion chamber most remote from the point at which combustion is initiated. To realize this condition in practice would require a combustion chamber form somewhat like Fig. 3; the combution should occur in a chcamber separated from the piston chamber, with walls hotter than the piston-swept

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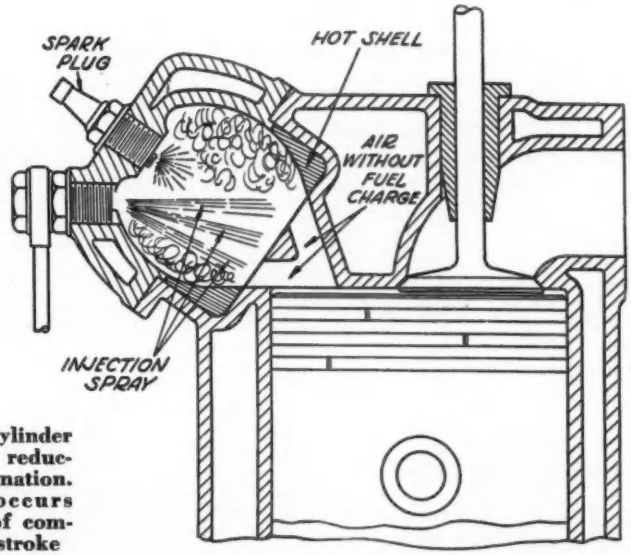
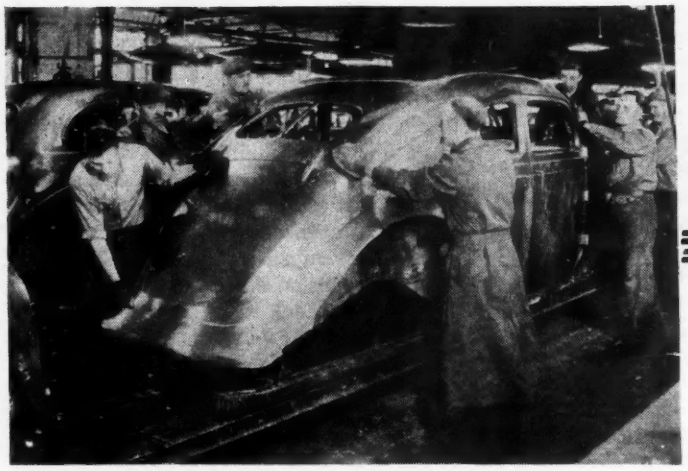


Fig. 3 — Cylinder type for reducing detonation. Injection occurs near end of compression stroke



PRODUCTION LINES

On the body inspection previous to painting the hand is keener than the eye at the Chrysler plant

Electrocast

Through the courtesy of Foundryman Martin and Adcrafter Kluender, we followed the Adcrafters on a little blowout at the Detroit Gray Iron Foundry. Here is one of the important elements in the Detroit industry, being responsible for much of the alloy iron casting for big body and fender dies. You probably know that recently they installed a 10-ton Lectromelt furnace for improving the quality of the alloy and consequently improving the life and durability of dies. They have molded and poured gray iron castings upwards of 42 tons in weight. Body or Fender dies averaging around 20 tons apiece are just duck soup for them.

Annual Allowance

Donald Horne has developed a most intriguing definition of depreciation in an article published in the May issue of *The Management Review*. Instead of treating depreciation as a loss he introduces the concept of a "cost" apportioned to the product. His definition would be—"the apportionment of the cost of productive facilities to the units of their product." Following this definition, the depreciation reserve represents the portion of the cost which has already been apportioned to the units of production, and the annual depreciation charge, as to any facility, represents the portion of its cost apportioned to the product of a particular year. Here is food for thought.

Industry's Part

The National Safety Council has published a booklet giving a 14-point plan for saving lives of factory workers. The interesting feature of the plan is the supervision of outside as well as inside activity from the point of view of safety. This will be evident from the following few topical headings—safe drivers' club, inspection of employee autos, parking facilities, vision tests, supervision of safety activities, etc. This project deserves your serious attention.

Dubonnet Car

From what we can learn, M. Dubonnet and his party are enjoying their stay in this country and are really making a big hit with the new streamlined, rear-engined car. One prominent engineer told us that this job had a very soft pleasing ride and was particularly good as to visibility due to the forward location of front seats. This same engineer had the car on the road at 90 m.p.h. in a cross wind of over 40 m.p.h. and found it more stable than a conventional car under the same conditions.

Rear Mounted

A representative of a Vancouver syndicate brought to our office the other day a model of a chassis incorporating a novel form of rear engine mounting with independent suspension for all wheels. In this construction vehicle loads are carried on a tubular dead axle mounted on leaf springs. The powerplant is suspended resiliently in a sub-frame which in turn is sprung on the dead axle. Independent springing for the front end is rather interesting as it incorporates a system of reverse linkages in which the knee-action springs, encased in separate housings, are mounted angularly above the axis of the front wheels. Judging by the model, the front end can encounter obstructions without transmitting vertical movement to the body. This construction is being offered both for passenger car and commercial chasses.

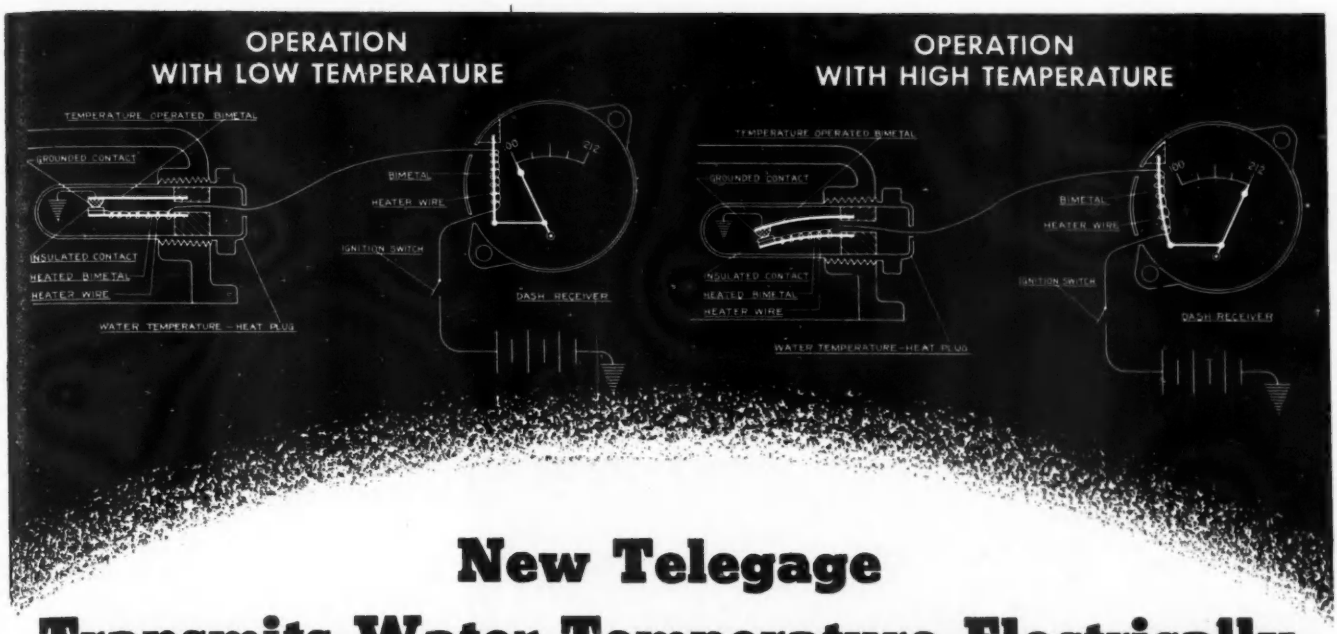
Octane Rating

Judging by the comments of a well-known engineer, more correlation data is needed between the rating of fuels on the CFR engine and performance on the road. Recently his company sent a test fleet of cars to various parts of the country and found that fuels having the same octane rating behaved differently in the engine. We believe that this point has been recognized by the co-operative fuel research group and it might be advisable to give its recommendations some early publicity.

Better Light

A number of times this year we have had occasion to do extended night driving in various sections of the country. And almost invariably we found that the headlights evidently were bothering oncoming traffic. This has happened with quite a number of 1936 models of different makes of cars. We know that our lights were bad because we had to take a dazzling signal from trucks and buses as they approached. Here is a real problem begging for solution—and it has an important bearing upon highway safety. —J.G.

MANUFACTURING MANAGEMENT METALLURGY



New Telegage
Transmits Water Temperature Electrically

By doing this job electrically an insulated wire replaces the conventional capillary tubing commonly used on this type of instrument. This eliminates, of course, any possibility of tubing breakage, also prevents spark knocks or other engine noises being transmitted to the instrument board. It results in a neater engine compartment, a saving in assembly costs, standardization of parts for all models, and a greatly improved field servicing condition.

The Elements of This Electric Telegage are:

1. A Bimetal in the "Heat Plug" with one end anchored, an insulated contact at the free end, and carrying an electric heating coil.
2. A "Receiver" Bimetal carrying a heating coil in series with "Heat Plug" heating coil and actuating the indicator needle.

How It Operates

1. Current in "Heat Plug" heating coil causes Bimetal to bend away from grounded contact. This breaks the circuit, the Bimetal cools, returns to original position, and again makes contact. This cycle then repeats.
2. A rise in water temperature causes Temperature Operated Bimetal to bend toward Heated Bimetal, thus forcing ground contact against Heated Bimetal. More current is then required to bend Heated Bimetal sufficiently to break circuit.
3. "Receiver" Bimetal behaves similar to Heated Bimetal in "Heat Plug."
4. Indicating needle connected to "Receiver" Bimetal thus records the water temperature.

Note: Both Bimetals in the Heat Plug are, of course, affected by an increase or decrease in engine water temperature. The physical characteristics of the Temperature Operated Bimetal are such, however, that its movement for a given temperature change is greater than that of the Heated Bimetal. As a result the pressure of the Grounded Contact against the Heated Bimetal increases in direct relationship to the increase in water temperature.

Over a period of three years more than 3,000,000 Telegages embodying this principle have been sold. User satisfaction is universal.

OUTSTANDING ADVANTAGES

1. No tubing to break, rattle or transmit engine noises to instrument board.
2. Standardization of units for all models.
3. A saving in assembly costs.
4. Neater engine compartment.
5. Guaranteed to withstand a temperature of 275° F without damage.
6. Makes removal of cylinder head an easier field operation.

All of which add up to Greater Car Owner Satisfaction

KING-SEELEY CORPORATION
ANN ARBOR MICHIGAN

Burning Bricks

(*Continued from page* 766)

transverse front spring. This is the only car with this front-end construction.

Mauri Rose is driving the F.W.D. entry again. A photo of the chassis shows the unique construction of this car. The drive from the rear end of the transmission to the fore and aft driveshaft is via four herringbone gears of 2-in. face. They are all carried on ball bearings. The use of four gears made it possible to keep the peripheral gear speed down and still put the side shaft far enough to one side to clear the flywheel housing. Both bevel and differential gears are carried in housings mounted on the frame. The drive to each wheel is through a short double universal jointed shaft transverse of the chassis. To keep both sides alike there is an extension on the driver's side of the car so the shaft does not cross over to the differential housing on that side.

A careful study of the F.W.D. chassis shows that dirt track Firestone tires are mounted on it. This brings up the subject of tire development at Indianapolis. When the first race was run some cars used 25 to 30 tires in a 500-mile race. Three years ago there was still considerable tire trouble, although many cars went through without a change. Today every driver expects to go through the race without a change. What has been done at Indianapolis deserves a shore résumé.

In 1924 the first balloon tires were used. They did two things—(1) added traction and (2) reduced driver fatigue. By 1930 four ply were replaced by six-ply tires from 5.25 to 6.00 in. section. Last year Firestone had been able to develop big tires that were stable enough to control a big car at high speed and were using 7.50 sections. This year they are offering 8.25. All of this development came out of the tests made during the summer of 1932, when Firestone took the heaviest racing cars then available and ran every type of tire to destruction. With a safety wheel attached this was possible. The safety wheel was a standard high-pressure 4-in. tire mounted on a wire wheel attached outside the wheels to be tested. When the test tire blew out the car dropped down on the 4-in. tire. That is why so much successful testing was accomplished. While this was brought to a head by racing, the results obtained have been invaluable to the public. Out of this experience all Firestone bus tires have been increased immensely in safety. Bus service is far harder than racing, for they are heavy, fast, run at high speed in high temperatures on the western roads and are a public conveyance.

The question is frequently asked whether or not these racing tires are like regular tires or not. The answer which I get from Waldo Stein, the Firestone representative, was that they are made from exactly the same materials and in the same manner, but there are slight external changes to suit the kind of racing they have to do: (1) The tread pattern and thickness varies; (2) side wall or scuff rubber is omitted; (3) tread harder and thinner. A bevel face tire with grooved edges is used on the oily dirt at Ascot track in Los Angeles. You could not hold a car at Indianapolis with them. On an ordinary dirt track a biscuit tread is used. At Indianapolis a very thin tread 5/16 in., with about three shallow grooves, seems to meet the requirements. Scuff

rubber is left off to reduce weight, which is very important with a tire rotating 1200 to 1500 r.p.m. So, while in appearance they differ from a standard tire, they are fundamentally the same.

Testing carburetors with exhaust analyzers is the latest fad at the track. It shows how much attention they are paying to gasoline economy.

Safety is another thing which the Technical Committee has been concerned with ever since there has been a race at Indianapolis. The demand has been for some device that would check vulnerable parts, such as steering arms and wheel spindles, for flaws before they caused trouble. Most tests damaged the parts to be tested. X-rays have been tried, but could not always be interpreted.

Already there have been two failures this year, both on front wheel drive cars. Both due to materials, not flaws. One had the ball on the steering arm shear off. The metal analyzed after the accident showed it was a low carbon steel ball and unheat-treated. The fracture looked like sugar. The other failure was on the F.W.D. when the bolts that hold the arm on the steering spindle sheared off. They were found to be too hard when tested. I mention these troubles, for the technical committee can hardly pass on anything except obviously unsafe design, but can hardly be expected to test all the material for its treatment.

However, they have installed a testing device this year which is quite wonderful in its positiveness and simplicity. For the first time in the history of the track the drivers had all their steering mechanism off and ready to test without coercion from the committee. Why? Because they could see defects no eye could observe even with a good microscope. The test is called Magnaflux and is very simple to make and interpret.

A spindle, piston pin, shaft or any part to be tested is mounted on an iron base. A coil of heavy insulated flexible conductor is passed around it. Five hundred to 800 amps. is passed through the coil magnetizing the piece. It is then dipped into an oil bath carrying suspended minute iron filings. Whenever there is a crack or defect there is a small horseshoe magnet in effect and the little iron filings gather at that point because the magnetic field is maximum there. Defects invisible to the eye show up immediately. Filing frequently will eliminate them and save the part. That is why the boys are testing everything on this machine; piston pins, connecting rods, etc., as well as the steering mechanism. This is just part of the great laboratory which is run here at the Indianapolis Motor Speedway once a year. Any engineer who has followed the developments down here can tell you many things which are now standard in your car today that developed here.

Spectroscopic Analyses of Fuel Combustion

Forschungsheft 377 of VDI-Verlag, Berlin NW 7, Germany, contains two papers on spectroscopic analyses of the combustion process, both based on experimental work carried out at Hannover Technical College. The first of these papers, "Zur Umsetzung in technische Flammen," by Dr.-Ing. Georg Beck, covers experiments on gas-oil flames which were investigated pyrometrically, gas-analytically and spectroscopically in the visible and ultraviolet ranges of the spectrum. The second paper, "Verbrennung im Dieselmotor" (Combustion in the Diesel Engine), by Dr.-Ing Ch. Erichsen, deals with a spectroscopic investigation of the flame in the combustion chamber of a Diesel engine.

Engine Types and Fuel Requirements

(*Continued from page* 775)

walls, which latter must be kept cool to maintain an oil film; special means must be used for mixing of air and fuel; the ignition point should be opposite the point of entry of air on compression, but screened from direct air-current impact; and the profile of the combustion chamber should be such that spherical spread of flame spouted from the spark plug points will not trap a body of combustible charge against a wall.

The problem of ignition is perhaps the most difficult. Care must be taken not to get the spark plug in the direct path of the spray, as at light loads it might foul up rather rapidly. In starting it may be necessary either to run for some minutes on gasoline or to use a burner of the same general character as the Fuelizer once used by Packard.

The author's comments on compression-ignition engines were relatively brief. He said his experience had shown him that trick shapes of combustion chambers were of much less importance than high wall temperatures on the bushings, thimbles, etc., employed with these various precombustion chamber types. From the fact that the best operation was obtained with metal temperatures far above the boiling point of the fuels used, he assumed that it was transmission of radiant heat, rather than conduction of fuel drops thrown on the walls, that was effective. He hazarded the prediction that any compression-ignition engine successful in aircraft work would use a fuel oil carefully refined as to grit, acid content, heating value and ignitability; and that it would be a two-cycle, streamline uniflow, positively-scavenged and supercharged engine, with short fuel lines; and either liquid cooled, or, if air cooled, with careful temperature control and throttling at idle.

Device Uses Engine As Braking Element

WITH vehicles equipped with a gasoline engine a considerable braking effect can be obtained by merely closing the throttle valve. This is impossible with trucks, etc., equipped with Diesel engines, owing to the fact that these engines normally have no throttle in the air passage. The French Westinghouse Company now has produced a device which enables an engine under braking conditions to function as an air compressor instead of as an idling air pump. This device, which is called an engine brake, consists of a valve in the exhaust line. The braking effect is said to be sufficient to hold a truck to a constant speed on down grades of considerable steepness, even in direct drive. Braking is progressive, that is, it comes on gradually, so that there is little danger of skids being caused. The device can be applied to both gasoline and Diesel engines. — *L'Officiel de L'Automobile*, April 19.

High-Speed Diesel Engines

High-Speed Diesel Engines, by Arthur W. Judge. Second Edition. D. Van Nostrand Company, Inc., New York.

THIS is a new edition of a British book which was first published in 1933. The treatise in general is of an elementary character and is largely descriptive. Not many changes have been made in the text, but a number of engines of recent design are described in the new edition and descriptions of certain earlier engines have been omitted. The section relating to engine fuels has been revised and the system of rating fuels in cetene numbers is described. The author has included typical Continental and American engines.